AGRICULTURAL UNIVERSITY OF ATHENS
DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION
MSC FOOD SCIENCE AND TECHNOLOGY & HUMAN NUTRITION
NUTRITION, PUBLIC HEALTH AND POLICIES

Master Thesis

Evaluation of the contribution of the food assistance program for vulnerable population groups: *Fund for European Aid to the most Deprived (FEAD)*

Konstantina Filippou

Supervisor: Prof. Maria Kapsokefalou

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Περίληψη

Εισαγωγή: Από την αρχή των μέτρων λιτότητας το 2009 έχει σημειωθεί αύξηση κατά 40% του επιπολασμού της επισιτιστικής ανασφάλειας σε ολόκληρη την Ευρώπη. Το Ταμείο Ευρωπαϊκή Βοήθειας προς τους Απόρους (ΤΕΒΑ) λειτουργεί σε ολόκληρη την Ευρωπαϊκή Ένωση (ΕΕ) και από το 2016 στην Ελλάδα με στόχο την παροχή υλικών (π.χ. τροφίμων) και μη υλικής βοήθειας στις πιο ευάλωτες πληθυσμιακές ομάδες. Μέχρι στιγμής λίγα είναι γνωστά για την αποτελεσματικότητά του στη βελτίωση των διατροφικών συνηθειών των ωφελουμένων του.

Σκοπός: Σκοπός της παρούσας μελέτης είναι η διερεύνηση του τρόπου με τον οποίο εφαρμόζεται το ΤΕΒΑ στην Ελλάδα και η αξιολόγηση της αποτελεσματικότητάς του στη κάλυψη των καθημερινών διατροφικών αναγκών των ωφελουμένων σε θεωρητική βάση χρησιμοποιώντας μια προσέγγιση προσομοίωσης.

Μεθοδολογία: Στην Ελλάδα, το ΤΕΒΑ χορηγεί επισιτιστική βοήθεια μέσω κεντρικών και αποκεντρωμένων προμηθειών. Η ανάλυση χρησιμοποίησε μια προσέγγιση προσομοίωσης, βάσει της οποίας συλλέχθηκαν δεδομένα και από τις δύο προμήθειες για τον υπολογισμό της ποσότητας των παρεχόμενων τροφίμων που αντιστοιχεί σε κάθε συμμετέχοντα και, συνεπώς, τη συμβολή τους στις διατροφικές του ανάγκες. Τα στοιχεία για την περίοδο Ιανουαρίου 2016 έως Δεκεμβρίου 2017 ανακτήθηκαν και αναλύθηκαν για τον υπολογισμό του ατομικού δικαιώματος ανά συμμετέχοντα σε γραμμάρια χωριστά για κάθε κοινωνική σύμπραξη. Τα τρόφιμα κατηγοριοποιήθηκαν σε επτά κατηγορίες τροφίμων: φρούτα, λαχανικά, σπόροι, κρέας και υποκατάστατα, γαλακτοκομικά, έλαια και ελεύθερα σάκχαρα. Βάσει των διατροφικών συστάσεων του Παγκόσμιου Οργανισμού Υγείας (ΠΟΥ), οι ποσότητες μετατράπηκαν από γραμμάρια σε μερίδες και κατόπιν υπολογίστηκε το ποσοστό της συνιστώμενης πρόσληψης για κάθε ομάδα τροφίμων χωριστά. Επιπλέον, για τις Κεντρικές Προμήθειες, πραγματοποιήθηκε και ανάλυση για να προσδιοριστεί η συμβολή της παρεχόμενης βοήθειας σε μακροθρεπτικά συστατικά. Στη παρούσα μελέτη, αναλύθηκαν μόνο τα τρόφιμα που παρέχονται από το ΤΕΒΑ και όχι δεδομένα σχετικά με το υπόβαθρο ή τις υπάρχουσες διαιτητικές προσλήψεις.

Αποτελέσματα: Τα τρόφιμα που δόθηκαν από τις Κεντρικά Προμήθειες ήταν πορτοκάλια, μήλα, λάχανο, συμπυκνωμένος χυμός ντομάτας, φέτα, εξατμισμένο γάλα, ωμό κοτόπουλο, μοσχάρι κρέας χωρίς κόκκαλα, χοιρινό κρέας χωρίς κόκαλα, λευκά ξηρά φασόλια, φακές, σπαγγέτι, ελαιόλαδο και ζάχαρη. Τα τρόφιμα που παρέχονται από τις Αποκεντρωμένες Προμήθειες διαφέρουν για κάθε κοινωνική συνεργασία που συμμετέχει στο Πρόγραμμα. Μερικά από αυτά τα τρόφιμα είναι τα ακτινίδια, τα καρότα, το ρύζι, οι πατάτες, οι ελιές και το μέλι.

Για την ομάδα των φρούτων των Κεντρικών Προμηθειών, το μέγιστο ποσοστό κάλυψης είναι 16,44% για μια αίτηση με ένα μόνο μέλος και το ελάχιστο ποσοστό

8,97% για μια αίτηση με έντεκα μέλη. Επιπλέον, για την ομάδα των λαχανικών το εύρος κυμαίνεται από 6,03% έως 0,55% και για τα δημητριακά από 4,57% έως 0,83%. Ταυτόχρονα, για την ομάδα των γαλακτοκομικών προϊόντων και του κρέατος και των υποκατάστατων, το εύρος κυμαίνεται από 3,04% σε 2,71% και από 13,70% σε 3,74% αντίστοιχα. Τέλος, για τα Έλαια και τα Ελεύθερα Ζάχαρα, η διαφορά μεταξύ μιας αίτησης με ένα μέλος και με έντεκα μέλη κυμαίνεται από 34,25% έως 3,11% και από 16,44% σε 1,49% αντιστοίχως. Επιπλέον, η ανάλυση μακροθρεπτικών συστατικών έδειξε μια τάση για αιτήσεις με μικρότερο αριθμό μελών να επωφεληθούν περισσότερο από την παροχή τροφίμων. Συγκεκριμένα, για αιτήσεις με ένα μέλος, το ποσοστό της ημερήσιας συνεισφοράς των Κεντρικών Προμηθειών φαίνεται να είναι δύο φορές υψηλότερο από τις αιτήσεις με περισσότερα μέλη. Σε μερικές περιπτώσεις, δηλ. διαιτητικές ίνες, ολικές λιπαρές ουσίες, πολυακόρεστα λιπαρά, μονοακόρεστα λιπαρά και κορεσμένα λιπαρά, η συμβολή ήταν ακόμη τριπλάσια.

Η περίπτωση των Αποκεντρωμένων Προμηθειών είναι πιο περίπλοκη εξαιτίας του τρόπου εφαρμογής του Προγράμματος. Για την ομάδα των φρούτων, ο ελάχιστος μέσος όρος μεταξύ των Κοινωνικών Εταιρικών Σχέσεων είναι 0,24% ανεξάρτητα από τα μέλη της αίτησης και ο μέγιστος 10,19%. Επιπλέον, για τα λαχανικά το εύρος κυμαίνεται από 0.62% έως 4.70% και για τα σιτηρά από 0.63% έως 9.87%. Ταυτόχρονα, για τα έλαια και τα ελεύθερα σάκχαρα, το εύρος μεταβάλλεται από 3,69% σε 24,38% και από 1,50% σε 16,30% αντιστοίχως.

Η συνολική συμβολή του FEAD βρέθηκε να είναι μικρότερη από 16%. Συγκεκριμένα, η ομάδα ελαίων φαίνεται να είναι αυτή με το υψηλότερο ποσοστό συμμετοχής σε κάθε περίπτωση (Κεντρική ή Αποκεντρωμένη) (άθροισμα μέσων 24,55%). Μετέπειτα, η ομάδα των φρούτων με 15,37%. Επιπλέον, για την ομάδα ελεύθερων σακχάρων η διατροφική συνεισφορά ανέρχεται σε 12,17% και για το κρέας και τα υποκατάστατα κρέατος σε 11,79% των καθημερινών αναγκών των ωφελούμενων. Ταυτόχρονα, για την ομάδα των σιτηρών το ποσοστό είναι 6,08% και το γαλακτοκομικά 5,96% αντίστοιχα. Τέλος, για τα λαχανικά η ημερήσια συνεισφορά είναι η χαμηλότερη (3,39%)

Συνολικά, υπάρχει μεγάλη ποικιλία μεταξύ των ομάδων τροφίμων τόσο για τις Κεντρικές όσο και για τις Αποκεντρωμένες Προμήθειες. Φαίνεται ότι το πρόγραμμα τείνει να ευνοεί τα μικρότερα νοικοκυριά με περισσότερη από τριπλή διαφορά στις παροχές τροφίμων ενός ατόμου και μεταξύ νοικοκυριών έντεκα ατόμων.

Συμπεράσματα: Η υλοποίηση του ΤΕΒΑ κατά το χρόνο της ανάλυσης έδειξε σχετικά μικρή συμβολή του προγράμματος στις διατροφικές ανάγκες των ωφελούμενων (λιγότερο από 16%) με μεγάλες ανισότητες. Αυτές οι ανισότητες τείνουν προς τα μεγάλα νοικοκυριά και έχουν ένα ασυνεπές γεωγραφικό πρότυπο (ενδεχομένως συνδεδεμένο με την εκτέλεση του προγράμματος ανά κοινωνική σύμπραξη). Παρόμοιες ανισότητες παρατηρούνται σε επίπεδο ομάδων τροφίμων και αυξάνονται

όσο αυξάνεται η επισιτιστική παροχή. Υπάρχει δυνατότητα αναθεώρησης του υπάρχοντος οδηγού για τη βελτίωση της διατροφικής επίπτωσης του προγράμματος.

Λέξεις-κλειδιά: επισιτιστική ασφάλεια, πρόγραμμα επισιτιστικής βοήθειας, διατροφική αξιολόγηση

Abstract

Background: Since the beginning of austerity in 2009 there has been a 40% increase in the prevalence of food insecurity across Europe. The Fund for the European Aid to the Most Deprived (FEAD) has been running across the European Union (EU) and since 2016 in Greece with an aim to provide material (e.g. food) and non-material aid to the most vulnerable populations. So far little is known about its effectiveness in improving the dietary habits of its beneficiaries.

Objective: The aim of this study is to investigate the way FEAD is implemented in Greece and through that evaluate its efficiency in helping meet the beneficiaries' daily nutritional needs in a theoretical basis using a simulation approach.

Methods: In Greece, FEAD delivers food aid through both Centralized and Decentralized Supplies. The analysis used a simulation approach, upon which data from both supplies were collected in order to calculate the food provision entitlement of each participant, and eventually its contribution to their dietary needs. Data for the period January 2016 to December 2017 were retrieved and analyzed to calculate the individual entitlement per participant in grams separately for each regional social partnership. Food provisions were categorized in seven food groups: fruits, vegetables, grains, meat and substitutes, dairy, oils and free sugars. Based on the WHO nutritional recommendations food provisions were transformed from grams to portions and then the percentage of the recommended intake for each food group separately was calculated. Moreover, for the Centralized Supplies, the same analysis was carried out in order to specify the contribution of the provision in macronutrients. Only the foods provided by FEAD were analyzed and no data on background/existing dietary intakes were analyzed.

Results: The foods provided by the Centralized Supplies were oranges, apples, cabbage, concentrated tomato juice, feta cheese, evaporated milk, raw chicken, boneless beef, boneless pork, white dry beans, lentils, spaghetti, olive oil, sugar. The foods provided by the Decentralized Supplies differ for every social partnership that participates in the Program. Some of these foods are kiwis, carrots, rice, potatoes, olives and honey.

For the group of Fruits of the Centralized Supplies, the maximum coverage rate is 16.44% for a petition with a single member and the minimum 8.97% for a petition with eleven members. Moreover, for the Vegetables Group the range varies from 6.03% to 0.55% and for the Cereals from 4.57% to 0.83%. At the same time, for the group of Dairy and the Meat and Substitutes the range alters from 3.04% to 2.71% and from 13.70% to 3.74% respectively. Finally, for the Oils and the Free Sugars the difference between an application with one member and with eleven members varies from 34.25% to 3.11% and from 16.44% to 1.49% correspondingly. Moreover, the

macronutrients analysis showed a tendency for applications with a smaller number of members to benefit more from the food provision. Specifically, for applications with one member, the percentage of the daily contribution of the Centralized Supplies seems to be two times higher than applications with more members. In some cases, i.e. Dietary Fiber, Total Fat, Polyunsaturated Fat, Monounsaturated Fat and Saturated Fat, the contribution was even three times higher.

The case of the Decentralized Supplies is more complicated because of the way the Program is implemented. For the group of Fruits, the minimum mean among the Social Partnerships is 0.24% regardless the application members and the maximum 10.19%. Moreover, for the Vegetables Group the range varies from 0.62% to 4.70% and for the Cereals from 0.63% to 9.87%. At the same time, for the Oils and the Free Sugars the range alters from 3.69% to 24.38% and from 1.50% to 16.30% correspondingly.

The total contribution of FEAD is found to be less than 16%. Specifically, the group of Oils seems to be the one with the highest contribution percentage in any case (Centralized or Decentralized) (sum of means 24.55 %). Following that, is the group of Fruits with 15.37 %. Moreover, for the Free Sugars Group the nutritional contribution is found to be 12.17 % and for the Meats and Meat Substitutes 11.79 % of the beneficiaries' daily needs. At the same time, for the group of Cereals the rate is 6.08 % and the Dairy 5.96 % respectively. Finally, for the Vegetables the daily contribution is the lowest (3.39 %)

Overall, there is great variability among the food groups both for the centralized and decentralized supplies. It seems that the program tends to favor smaller households with more than threefold difference in the food provisions per person between one- and eleven-people households

Conclusion: The setup of FEAD at the time of the analysis, showed a relatively small contribution of the program to the dietary needs of the beneficiaries (less than 16%) with great potential for inequalities. These inequalities are skewed towards large households and have an inconsistent geographical pattern (potentially linked to the program's execution per social partnership). Similar disparities are seen in the food group level and are augmented with the increasing volume of food provisions. There is potential for a review of the existing guide to improve the program nutritional impact.

Key Words: food security**;** food assistance program; nutritional evaluation

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Abbreviations

WHO	World Health Organization
FAO	Food and Agriculture Organization
UN	United Nations
SDG	Sustainable Development Goal
NCD	Non-Communicable Disease
UNICEF	United Nations International Children's Emergency Fund
SNAP	Supplemental Nutrition Assistance Program
FNS	Food and Nutrition Service
US	United States
FEAD	Fund for the European Aid for the Most Deprived
EU	European Union
MS	Member States
MDP	Most Deprived Persons
SOREAL	Solidarite Reseau Alimentaire
MA	Managing Authority
OG	Operation Guide for the Business Program I Food or/and Basic Material Assistance of FEAD

Contexts Table

1. Introduction

1.1. Global changes in Nutritional Habits and their impact on Health

Between 1990 and 2010, real per capita incomes grew by nearly 2 percent annually on a global scale, but not without major differences among countries and between decades.[1] This growth resulted in changes in food consumption and an increase in dietary energy supplies. According to FAO, dietary energy supplies increased during this period by about 210 kcal per person per day, or 8 percent on average, for the entire world. The increase was larger in the developing countries (275 kcal/person/day) than in the developed countries (86 kcal/person/day) (Figure 1).[2]

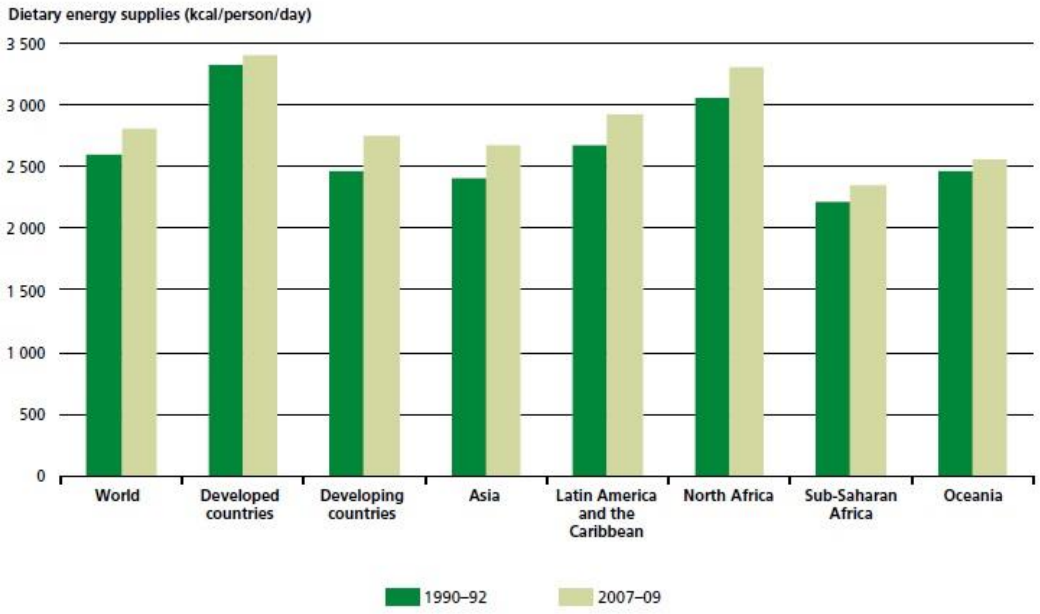

Figure 1: The Increase of the dietary energy supplies since 1990 around the world

Despite the relatively smaller changes in energy supplies, developing countries are experiencing large changes in the state of nutrition as they enter the state of nutrition transition. This is characterized by a shift in traditional patterns of consuming foods rich in fibers and grains, and higher relative levels of physical activity, towards an increase in the consumption of sugar, refined grains, animal fat and protein, as well as in lower relative activity, as the average wealth grows.[3] Primarily, this transition felt to be limited to higher-income urban populations, but it is increasingly clear that it is a much broader trend affecting all segments of society.[4]

All of the above changes, that have been occurring particularly in the last one or two decades of the 20th century, are reflected in nutritional outcomes, such as changes in average body composition and morbidity.[4] Overnutrition, which is the main reason for overweight and obesity, is considered a form of malnutrition alongside with undernutrition, and/or inadequate intakes of vitamins and minerals.[5]

The newly adopted dietary patterns of low fruits, vegetables and whole grains consumption, alongside the excess intake of saturated fat, salt and sugar are considered to be major risk factors for the development of non-communicable diseases (NCDs) development like cardio-vascular diseases, cancer, obesity and type 2 diabetes. Several studies mention that societies are burdened by premature mortality and morbidity associated with chronic disorders.[6] In 2008, 36 million deaths were attributed to cardiovascular diseases and diabetes, cancers and chronic respiratory diseases (63% of global deaths), including more than 14 million people who died at the ages of 30 and 70.[7] Low- and middle-income countries already bear 86% of the burden of these premature deaths (Figure 2).[8]

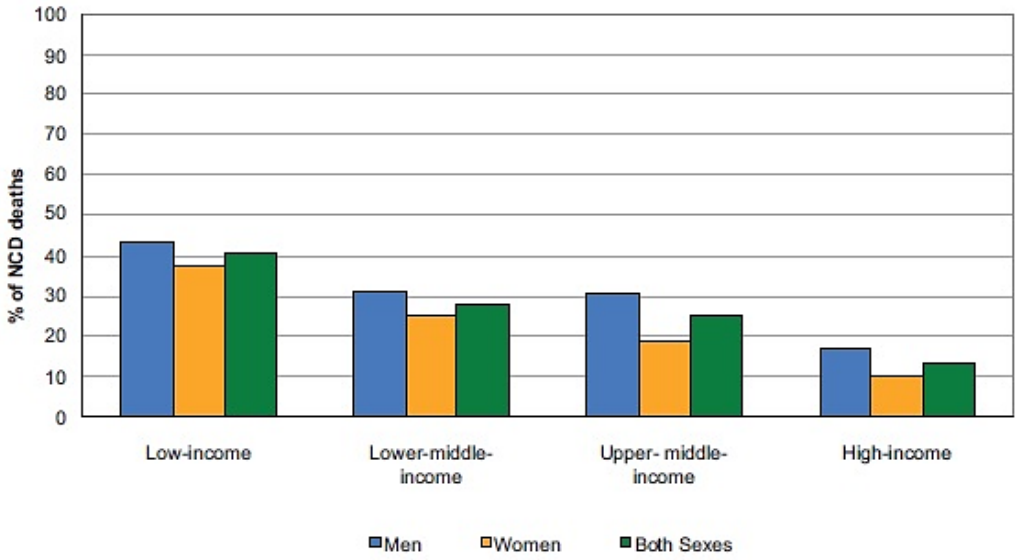

Figure 2: Proportion of global NCD mortality in men and women under 60 years of age by country's income.
Source WHO. Non-Communicable Diseases Country Profiles. (2011)

Micronutrient deficiencies and overnutrition in children and adults have become two major food security and nutrition concerns, both of which result in reduced human capacity, and productivity losses. According to WHO, NCDs are considered a public health challenge that undermines both social and economic development. They create heavy social and economic burdens for societies by affecting people's health, wellbeing and productivity. Lastly, it is estimated that a large amount of money is wasted because of loss of productivity and price of health care without taking action over the next 20 years.[9]

1.2. Economic crisis and Nutritional Habits

Even though low- and middle-income countries faced an economic growth during the past twenty years, growth rates for high-income countries slowed in the 2000s.[2] In 2007, the International Financial Crisis took place originating in the United states of America and until 2008 it was transformed in the World Economic Recession.[10] The impact of the economic crisis is noticeable in many sectors such as the international trade, the economic growth, employment and the health status of a population.[11]

During an economic crisis, employment is one of the most affected areas. Most of the population lies in conditions of work insecurity which eventually leads in loss of working capacity.[12] There is always the concern that the economic downturn affects the public health as a result of job losses. People living in the brick of poverty are likely to be affected by different forms of malnutrition, by adopting less healthy lifestyles such as increased consumption of cheap food with little nutritional value as a response to stress.[13] This condition increases health care costs, reduces productivity and slows economic growth, which can perpetuate a cycle of poverty and ill health.[14]

Economic factors like income and food price shape consumers' food choice behaviors, and eventually influence their nutritional status.[15,16] Research has shown that the effects of increased income have generally been viewed as beneficial, since higher income is associated with better quality diets, better health care, better child growth, and lower morbidity and mortality from infectious diseases.[17] As income reduces, economic insecurity increases as a result of unemployment and as a result a shift to more energy-dense foods, enlarged consumption of sugar and refined grains exists. As a rule, potato chips, chocolate and soft drinks pro- vide dietary energy at lower cost than do naturally hydrated lean meats, fish, fresh vegetables and fruits. The inverse relationship between energy density and energy cost suggest that "obesity-promoting" foods are simply those that offer the most dietary energy at the lowest cost.[18]

Since 2009, Greece has been facing a financial crisis with severe consequences in the socio-economic sectors. Austerity policies, including large-scale cuts and public sector reforms were imposed for financial rescue packages.[10] That led up to Greece, according to Eurostat regional yearbook 2017, being placed among the countries with higher unemployment rates that were affected by the sovereign debt crisis, specifically 23.6%, along with Spain, France and Italy.[19] Moreover, for Greece of the total unemployed population, 74% have been unemployed for over 12 months, signifying a potential health burden for the unemployed and their dependents.[20] Furthermore, more than a third of the Greek population was at risk of poverty or social exclusion, specifically 36%.[21]

As mentioned above, there are indications that economic crisis results in changes in food consumption and nutrition worldwide, with particular impact on vulnerable populations. It would therefore be reasonable to assume that a similar situation exists

in Greece. WHO estimates that in 2014, 66% of men and 55% of women in Greece were overweight (body mass index ≥25), with an increase of two percentage points since 2010 for both sexes. In addition, Greek women were more likely to be obese (24%) than men (22%).[20]

A lot of studies have examined the effect socio-economic status has on food habits, and they all seem to agree that higher socio-economic positions are more likely to follow healthier food habits.[18,22] However, this situation is not only limited in adults, but it has a severe consequence in children as well. As M. Yannakoulia *et al.* mentions in her research in low-socioeconomic areas, diet quality is strongly influenced by socio-economic parameters in children and adolescents.[23]

Apart from the variations in the dietary patterns, changes because of the economic crisis are, also, noticeable in other sectors. Life satisfaction (a measure of subjective well-being) is lower in Greece than the average for the European Region. Among objective well-being measures, 61% of people aged over 50 years reported that they had relatives or friends on whom they could count when in trouble, which is among the lowest proportion in the Region.[20]

To sum up, the absence of economic growth, means loss of income and employment, and reductions in social assistance for the most vulnerable members of society.[10] Therefore, governments and authoritative bodies need to take action to protect people in need.

1.3. Food Security and the state of it around the world

The WHO and FAO are established as the official bodies in taking action towards reducing inequalities. According to World Health Organization (WHO), the definition of health concerns not only the physical, that is absence of a disease or a disability, but also the mental and social well-being. It is essential for the preservation of peace and security and depends upon the fullest co-operation among all individuals.[24] The environment that someone is born, grows, lives, works and ages plays a very important role in formulating his health condition. These are called the *social determinants of health*[25] and are formed by the distribution of money, power and resources at global, national and local level.

Another determinant of health is food security. *Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*.[26] This definition includes all four different dimensions of food security: food availability; accessibility (physical, economic and sociocultural); utilization and lastly stability of all these scopes.[27]

Food security has been a central issue of discussions around the world for many years. President Franklin D. Roosevelt in 1941 identified the 'four essential freedoms': freedom of speech; of worship; from want; and from fear – 'everywhere in the world'.[28] The Food and Agricultural Organization of the United Nations (FAO) in its founding conference related *freedom from want* with food and agriculture, and as an extension to that ensuring humanity's freedom from hunger was established as the main purpose for the foundation of FAO.[29] Therefore, the importance of access to sufficient, safe and nutritious food has been set and emphasized since the early years due to its key role in the maintenance of dignity, peace and prosperity throughout the planet. Based on that, on 25th September 2015 countries members of the United Nations (UN) adopted a set of Goals (Sustainable Development Goals, SDGs) with multiple targets each one as part of a new Sustainable Development Agenda 2030 (Figure 3).[30]

Figure 3: The 17 Sustainable Development Goals of the United Nations

Ending poverty (SDG 1) and Achieving Zero Hunger (SDG 2) are the top two goals. SDG 1 aims to ensure social protection for the poor and vulnerable, increase access to basic services and support people harmed by climate-related extreme events and other economic, social and environmental shocks and disaster. Food is one of the basic human needs. Hunger and malnutrition mean less productive individuals, who are more prone to disease and thus often unable to earn more and improve their livelihoods.[31] That is why SDG 2 aim is to ensure access to safe, nutritious and sufficient food for all (Target 2.1) and eliminate all forms of malnutrition (Target 2.2).[32] Within the framework of the SDGs, FAO launched in September 2017 *The State of Food Security and Nutrition in the World*, marking the beginning of a new era in monitoring progress towards achieving a world without hunger and malnutrition.[33]

However, whilst it seems that a lot of effort is being put to achieve *food security*, there has been a rise in world hunger the last three years. The absolute number of undernourished people, that is those facing chronic food deprivation, has increased to nearly 821 million in 2017, from around 804 million in 2016 (Figure 4).[33] The situation is getting worse in South America and most regions of Africa, while the decreasing trend in undernourishment that characterized Asia seems to be slowing down significantly.[34]

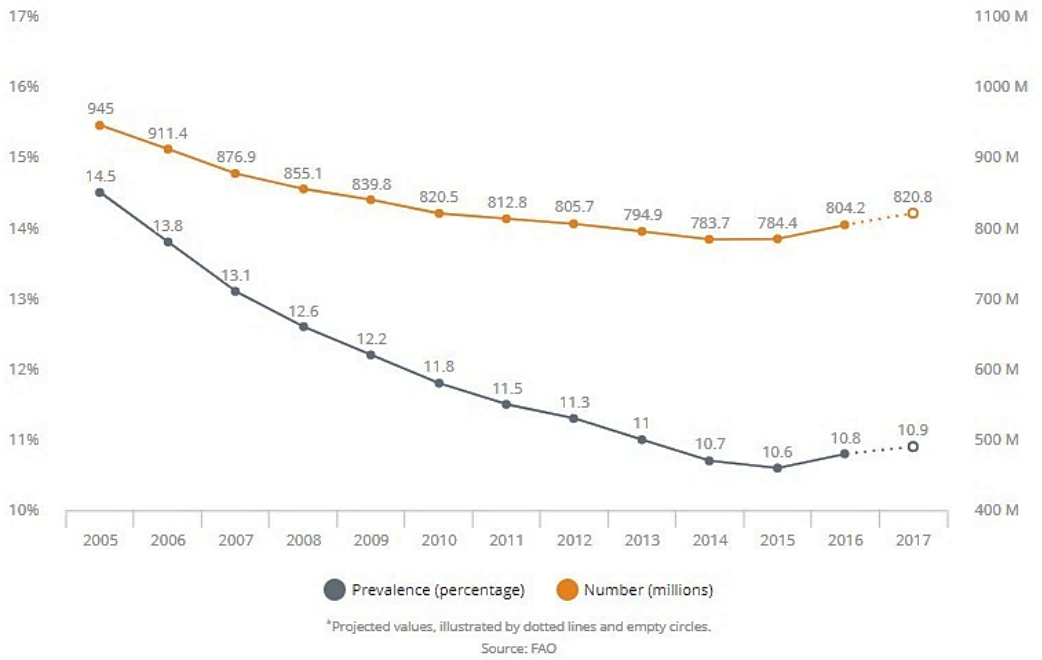

***Figure 4**: Prevalence and number (in millions) of undernourished people in the world during the period 2006-2017.[33]*

At the same time, multiple forms of malnutrition are coexisting, with countries experiencing simultaneously high rates of child undernutrition and adult obesity, and vice versa.[1] This is also known as *the double burden of malnutrition*.[35] An average of 1.9 billion adults worldwide are overweight, while 462 million are underweight. Moreover, it is estimated that 41 million children under the age of 5 years are overweight or obese, while some 159 million are stunted and 50 million are wasted. In addition, 528 million or 29% of women of reproductive age around the world are affected by anemia, for which approximately half would be amenable to iron supplementation.[36] Last but not least, a large proportion of the world population is also affected by micronutrient (vitamin and mineral) deficiencies, often called "hidden hunger" because there may be no visible signs.

The causes for food insecurity vary from unavailability of food, insufficient purchasing power, inappropriate distribution to inadequate use of food at household level or individual level (Figure 5). However, the primary issue remains accessibility. Although, adequate amounts of food are being produced, they may not be accessible by the hungry due to price, distribution, income limitations or cultural factors. Moreover, appropriate use of the accessible food is necessary, for this requires a safe and proper food preparation, as well as quality of nutritional diets.

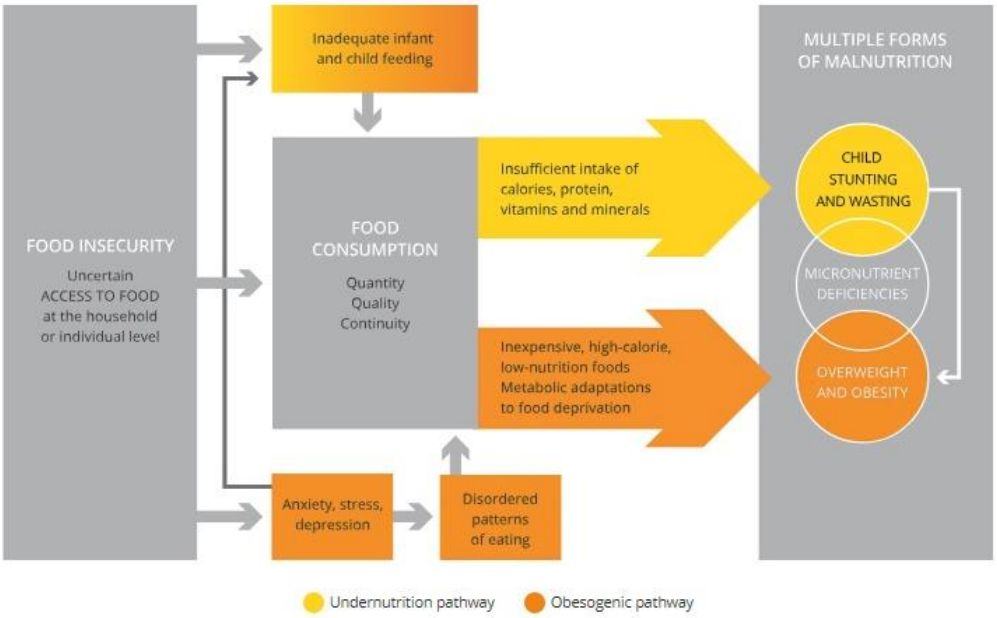

Figure 5: Pathways from inadequate food access to multiple forms of malnutrition[33]

1.4. Food Security in the European Region

Regions like sub-Saharan Africa, Latin America and western Asia are the most common when it comes to mentioning examples of areas where nutrition transition takes place. [37,38] Europe is usually neglected, despite the large economic and social changes that have affected it. For example, Italy, Greece, Cyprus and Ukraine were negatively impacted by the 2007-08 financial crisis and the fiscal austerity measures that were introduced thereafter.[39] Indications, that an economic crisis results in changes food consumption around the world, with an important impact on vulnerable populations, have been reported in studies.[40] Thus, since 2010, the prevalence of food insecurity was about 2.71% points greater than would have been expected on the basis of previous trends and corresponds to an excess of about 13.5 million people living with food insecurity in the European Union.[21]

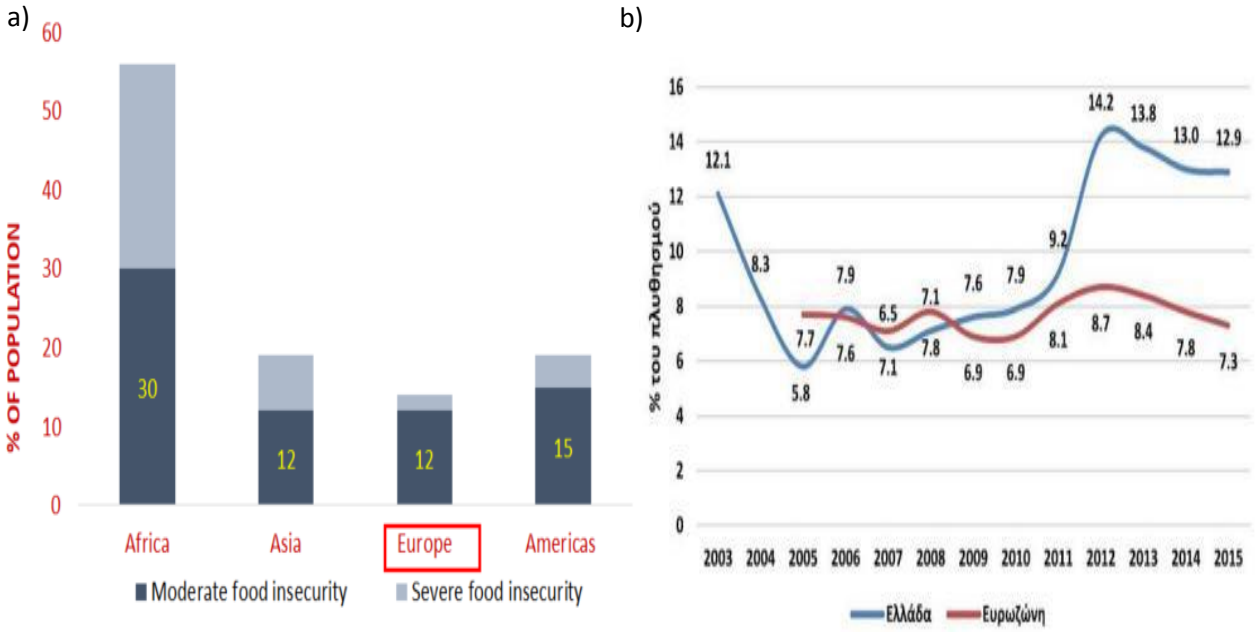

Figure 6: *a) Global prevalence of food insecurity and b) prevalence of food insecurity in Greece (blue) and European Union (red) from 2003 to 2015*

In general, most of the cases of malnutrition in the European Region, according to the Food and Agriculture Organization of the United Nations (FAO), can be divided into four broad categories[41]:

1) Countries primarily affected by undernutrition and micronutrient deficiencies, but with relatively low prevalence of over-nutrition. (e.g. Azerbaijan, Georgia)
2) Countries with the triple burden of malnutrition, characterized by residual undernutrition, persisting micronutrient deficiencies and rapidly growing rates of obesity and overweight. (e.g. Albania, Armenia, Bulgaria)
3) Countries primarily affected by overnutrition. (e.g. Belarus, Germany, Spain)

4) Countries where food security concerns are relatively low. (e.g. Austria, Denmark, Greece)

However, the biggest issue for the region is by far overnutrition, which affects 59% of the population and is placed among the three major risk factors for premature mortality in the European Region [42] These high rates of obesity result in increases in NCDs, and in Greece, for example, the probability of dying between ages 30 and 70 years from the 4 main NCDs is 13%.[43]

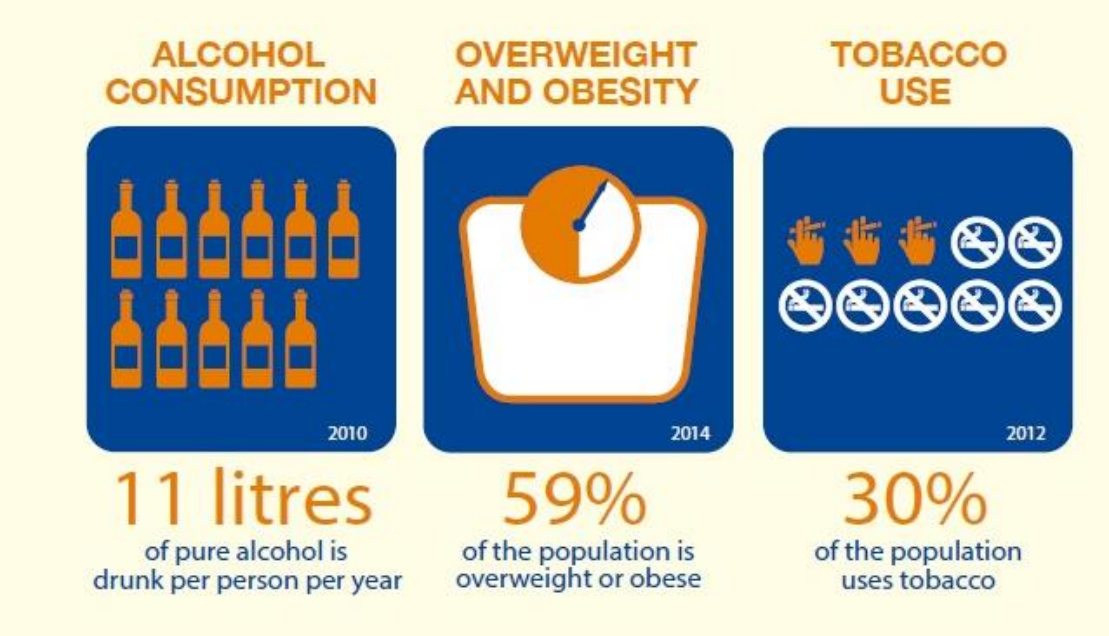

Figure 7: The three major risk factors for premature mortality in the European Region.
Source WHO- The European health report 2015, targets and beyond – reaching new frontiers in evidence.

1.5. Food and Nutrition Policies

A policy is defined as a statement by an authoritative body of an intent to act in order to maintain or alter a condition in society. Specifically, nutrition-sensitive food policies and programs entail setting clear nutrition objectives, monitoring nutritional impacts, improving nutrition knowledge and practices, diversifying food production, ensuring food safety, reducing food losses, generating income for the poor, and empowering women, in development as in emergencies, in rural areas as in urban settings (FAO, 2017).

Nutrition policies are developed to combat all forms of malnutrition. The ones that are targeted at low, middle income or developing countries have different approaches depending on the goal that they are willing to achieve. First of all, there are the direct nutrient-based interventions, such as nutrient supplementation and food fortification. A different approach, mostly the ones developed by e.g. WHO, FAO or UNICEF, is the provision of nutritional education to guide the groups in need. For example, the importance of exclusive breast feeding for at least the first six months of age or the dietary guidelines for healthy eating. Finally, the development of agricultural and trade policies that assure availability and access to nutritious food through which hunger can be prevented and health of an entire population at all stages of life is being promoted and sustained.[44]

A lot of efforts are being made throughout the world to develop nutrition policies that will have a positive impact on the targeted population. An example is the *European Food and Nutrition Action Plan, 2015-2020* developed by WHO for the reduction of childhood obesity. In the United Kingdom, *Healthy Start* distributes vouchers to pregnant women and new mothers to purchase milk, fresh and frozen fruits and vegetables and infant formula and vitamins.[39] Moreover, two different policies, one for the American and one for the European population, are mentioned below in detail. These two policies are intended to assist populations that are living on the brick of poverty. The greatest difference between those, is that the European one provides food aid to people in need, but the American one provides purchasing power with the right to choose.

1.6. The Supplemental Nutrition Assistance Program, SNAP (USA example)

The Supplemental Nutrition Assistance Program (SNAP) is one of the most popular food policies against hunger in America. It has been implemented for more than 40 years and was formerly known as the Food Stamp Program. It is a federal aid program, administered by the U.S. Department of Agriculture, under the Food and Nutrition Service (FNS).

Through this program nutritional assistance is provided to low- or no-income individuals and families across the United States, with its main purpose to reduce food insecurity which is a measure of whether a household experiences food access limitations because of lack of money or other resources.[45] SNAP benefits are provided monthly to the participating households via an electronic debit card. They are limited to the purchase of food items for use at home as well as seeds and plants to produce food. Alcohol and tobacco cannot be purchased with these benefits.[46]

The amount of the benefits that is distributed to every participating household depends on the individual income. More specifically, the Thrifty Food Plan, a nutritious food plan that reflects current nutrition standards and guidance of US, is used to calculate the minimum cost for grocery shopping. The SNAP program assumes that 30% of each household's income would be allocated to food purchase, and it supplements the remaining amount until this minimum cost.[46]

Because of the program's size and importance, there is substantial policy interest in assessing its effectiveness.[47] A lot of studies have been conducted in order to investigate whether the SNAP program helps reduce food insecurity in America. Although there are various limitations in each one of them, a positive effect of SNAP in improving food security has been recorded in most of them.[47–49] For example, a study compared information collected from SNAP households within days of program entry with information collected from a contemporaneous sample of SNAP households that had participated for approximately 6 months.[45] The results suggested that the program reduced food insecurity as well as very low food security, meaning that it has accomplished its goal.

Nearly half of SNAP participants are children, a fact that has also raised awareness of the scientists and other stakeholders. However, little is known about how SNAP affects children's food security, and not a lot of studies have examined that. The findings on those who have done that, indicate that SNAP participation was associated with an approximately one-third decrease in the odds of children being food insecure.[50]

As mentioned above, SNAP was associated with a reduction in, but not elimination of, food insecurity. This fact leaves space for additional research which will help identify the factors associated with food insecurity among SNAP participants, whether they are adults, children or elderly. There is value in examining how low-income

households make their food purchase decisions, to determine the roles that SNAP benefits play in this process.

1.7. The Program 'Fund for European Aid to the Most Deprived', FEAD (EU example)

The 'Fund for European Aid to the Most Deprived' was set up in the 2014 to 2020 programming period, targeting the most deprived people in the all member states (MS) of the European Union. Five hundred forty-three million euros, on average, are spent per year from 2014 until 2020 for all the MS. The Program follows up on the 'Food Distribution Program for the Most Deprived Persons' (MDP) which was created in 1987 until 2013 to make meaningful use of agricultural surpluses by making them available to most of the Member States as food aid for the most deprived.[21]

The FEAD is a program that involves all the countries and through which material support is provided to the most deprived and disadvantaged people. The aid might be in the form of food, clothing and other essential items for personal use, e.g. soap and shampoo. However, national authorities may also provide non-material assistance to these people, to help them integrate better into society and at some point, help them out of poverty.[51] It is estimated that 15.2 million people received food support, 636.000 material aid and nearly 23.000 social inclusion support in 2016.[21]

There is no specific way in which the program is implemented for all the countries. The Commission approves the national programs, on the basis of which each national authority takes decisions leading to the delivery of the assistance through partner organizations (often non-governmental). In this way, every country may choose what type of assistance (food or basic material assistance, or a combination of both) they wish to provide, and how the items are to be obtained and distributed, depending on its own situation.

National authorities can either purchase the food and goods themselves and supply them to partner organizations or fund the organizations so that they can make the purchases themselves. The partner organizations are public bodies or non-governmental organizations selected by each national authority according to objective and transparent criteria defined on national level. The organizations that buy the food or goods themselves can either distribute them directly or ask other ones to help.

However, it is important to keep in mind that, FEAD is not meant to replace public policies undertaken by the Member States of the European Union to fight poverty and social exclusion.[21] National policies also play a key role in preventing the marginalization of vulnerable and low-income groups and averting the increased risk of poverty and social exclusion.

1.8. Implementation of the FEAD Program in various Countries of the European Union[52]

Having mentioned above how the 'Fund for European Aid to the most Deprived' program works in general, it would be interesting to examine the way it is implemented in different countries of the European Union.

In Belgium, the food aid is distributed for free to people living under the poverty threshold, including migrants and refugees, through public social welfare centers and other registered partner organizations. As food waste is a major problem of concern nowadays, they have developed a project (The SOREAL Platform - Solidarité Réseau Alimentaire - Solidarity Food Network) through which unsold food products are collected and swiftly distributed to local food organizations that assist the most deprived people in the region. Redistributed food is subsequently used in the distributed food parcels, to prepare meals in reception centers, as well as in workshops or meals made by professional chefs.

The program in Bulgaria finances the distribution of individual food packages, which are provided to people who meet the eligibility criteria for the program, in the region. Also, a variety of accompanying measures to support end recipients in their transition out of poverty and social exclusion are provided as part of FEAD, in the Bulgarian Region.

Croatia provides both food and material assistance to the recipients through the FEAD program, in order to support disadvantaged households and homeless people. At the same time, a different project as part of the program is running in the schools at the City of Virovitica in Croatia providing a daily meal to children in need. This project aims to end the inequalities in childhood nutrition. A similar action takes place in the region of Czech Republic. The Czech FEAD Managing Authority has decided to support the group of children, who cannot afford the cost of their school lunches.

In Ireland, as part of FEAD the food assistance is provided to vulnerable families and people in need but also the matter of food waste is being taken into consideration. Through the FoodCloud Hubs businesses are connected with large volumes of surplus food to charities that distribute food aid in communities across the country.

Apart from the food and basic material assistance, part of the FEAD funding in Italy is being used to support a project named the Housing First Network Italy (NHFI). The project is being led by a non-profit organization and its aim is to reduce the number of homeless people across the Italian municipalities.

The end recipients in Spain benefit from FEAD by receiving prepared meals in social canteens. The contents are selected according to basic criteria that will help meet the needs of the beneficiaries. Each year since 2015, in order to identify the potential FEAD recipients, Bancosol Alimentos, the foodbank association that covers the Costa del Sol and wider Málaga area, conducts a professional assessment, through which an annual "social report" is provided regarding each end recipient. This report explores the

family situation of a potential FEAD recipient and the key social and economic challenges to which they are exposed. If the recipient fits the criteria, he is able to participate in the program and receive the provision of food assistance.

In Greece, since January 2016, various food products have been provided through the Program to the beneficiaries. The Program is implemented through the 57 Social Partnerships, that provide food either in the form of Central Procurement or Decentralized. Specifically, the *Central Procurement* is purchased through public tenders from the Managing Authority (MA). In the case of the *Decentralized Supplies* the Lead Partner Organizations from every Social Partnership receive a grant that use for the relevant procurement through contests by applying them corresponding to laws and regulations on public procurement. Such competitions are expected to be made for fresh products and generally short products expiration dates or specific species change by season (e.g. fruit and vegetables).[53]

FEAD as a food assistance program was created in order to respond to the need of increasing food security across the EU. Each country implements FEAD in a different way, some of them with great success. However, there is a gap in understanding the impact of FEAD on eliminating food insecurity, achieving the desired nutritional intake according to the recommendations of the beneficiaries. Thus, following international practices, this study was conducted.

2. Methodology

2.1. Objective of the study

The purpose of this study is to understand the way FEAD is implemented in Greece and through that to estimate the nutritional contribution and impact of the program to its beneficiaries. This study is a simulation approach using official data in order to calculate the food provision entitlement of each participant of the FEAD Program in Greece. The data that were used were collected from January 2016 to December 2017. It is important to mention that this kind of research has not been carried out in none of the EU countries that implement the Program.

2.2. Data Collection

For this study, the collected data come from two sources: the *Operation Guide for the Business Program I Food or/and Basic Material Assistance of FEAD* (1st Edition)[54] (OG) and the official national records for every social partnership around the country. As mentioned above, foods in Greece are delivered in as Centralized or Decentralized Supplies. For the first ones, the OG was used in order to specify the kind and the number of items of provided foods that correspond to every application. These types of food are olive oil, raw chicken, boneless beef and pork, white dry beans, lentils, feta cheese, sugar, spaghetti, concentrated tomato juice, evaporated milk, apples, oranges, and cabbage (Appendix A). The items were converted into grams, using the given weight of each package (for example one item of boneless beef weights 500 gr). Simultaneously, the foods were categorized into seven food groups (i.e. fruits, vegetables, grains, meat and grains, dairy, oils and free sugars) using the WHO recommendations[55]. At this point, the total calculated weight for the food provision was transformed into the daily amount of food that corresponds to every application for every food group. Continuing on, the quantity was calculated per person. Using the recommended daily intake per food group and the daily amount that corresponds to each applicant, the percentage of coverage of daily needs were computed. The schematic depiction of the methodology is presented in the figure below (Figure 8). Moreover, using the program DietAnalysis Plus the energy and the macronutrients carbohydrates, dietary fiber, proteins, total fat, saturated, monounsaturated, and polyunsaturated fat were computed for all the possible number of members in an application.

In order to specify the contribution rate of the Decentralized Supplies, for the Social Partnerships that delivered food aid during the examined period, the same methodology was used with slight differences that are represented in the figure below.

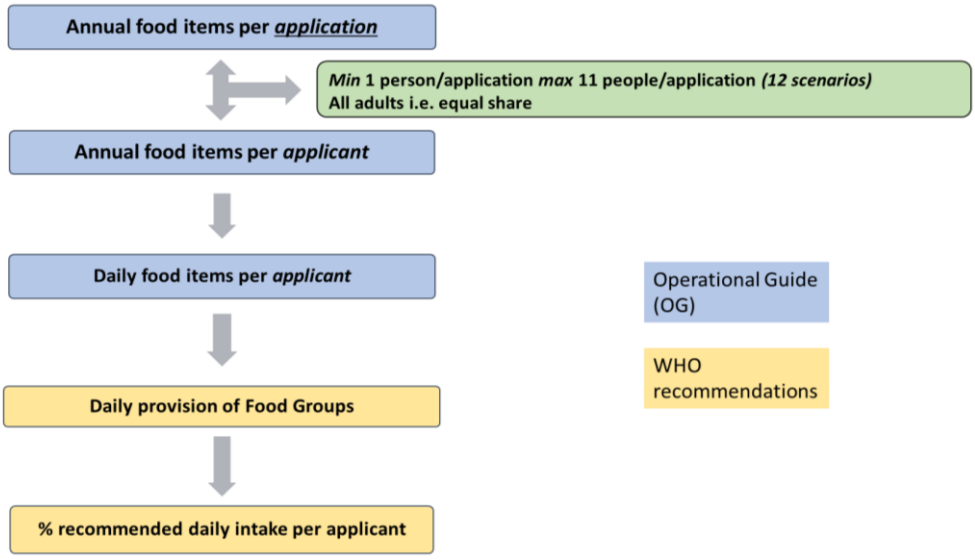

***Figure 8**: Schematic illustration of the methodology used for the Centralized Supplies*

2.3. Statistical Analysis

The results are presented as percentages for the Centralized and the Decentralized Supplies. For the total contribution, the sum of mean was calculated. Box plots were used for the presentation of ranges and bar graphs for the proportions. Microsoft Office Excel 2007 was used for the calculation of the contribution rate in the daily nutritional needs of the beneficiaries, as well as for the creation of the graphs. The DietAnalysis Plus was used for calculating the contribution rate of the Centralized Supplies to the needs of the program participants for macronutrients.

3. Results

3.1. General Description of the Population

The study sample for this particular study is all the people who benefit from the FEAD program. Until May 2017, economic criteria were specifically established in order to enable a person to be part of the FEAD. However, with Ministerial Decision[56] from July 2017 until today, the lists of the beneficiaries are renewed every month. This has happened due to change in the socioeconomic criteria, which was caused by the combination of the Social Income of Solidarity and the FEAD in Greece.

3.2. Centralized Supplies

3.2.1. Analysis of Nutritional Contribution in Food Groups

The percentages of the daily coverage per person for every food group are presented in Table 1 and Figure 9. The range varies depending on the number of the members in an application and on the kind of food group. Applications with one person seem to benefit the most. More specifically, they receive double the amounts of Vegetables, Meats and Meat Substitutes, Oils and Free Sugars even from applications with two members. This difference is becoming more noticeable as the members of application grows bigger. For the group of Fruits, the maximum coverage rate is 16.44% for a petition with a single member and the minimum 8.97% for a petition with eleven members. Moreover, for the Vegetables Group the range varies from 6.03% to 0.55% and for the Cereals from 4.57% to 0.83%. At the same time, for the group of Dairy and the Meat and Substitutes the range alters from 3.04% to 2.71% and from 13.70% to 3.74% respectively. Finally, for the Oils and the Free Sugars the difference between an application with one member and with eleven members varies from 34.25% to 3.11% and from 16.44% to 1.49% correspondingly.

Table 3-1: Percentage of the daily coverage per food group and person depending on the number of members in an application

Number of members per application / Percentage of the Daily Coverage per person	Fruits (%)	Vegetables (%)	Cereals (%)	Dairy (%)	Meat and Substitutes (%)	Oils (%)	Free Sugars (%)
1	16,44	6,03	4,57	3,04	13,70	34,25	16,44
2	12,33	3,01	4,57	3,04	8,99	17,12	8,22
3	10,96	2,01	3,04	2,91	6,85	11,42	5,48
4	10,27	1,51	2,28	2,84	5,78	8,56	4,11
5	9,86	1,21	1,83	2,80	5,14	6,85	3,29
6	9,59	1,00	1,52	2,77	4,71	5,71	2,74
7	9,39	0,86	1,30	2,75	4,40	4,89	2,35
8	9,25	0,75	1,14	2,73	4,17	4,28	2,05
9	9,13	0,67	1,01	2,72	4,00	3,81	1,83
10	9,04	0,60	0,91	2,71	3,85	3,42	1,64
11	8,97	0,55	0,83	2,71	3,74	3,11	1,49

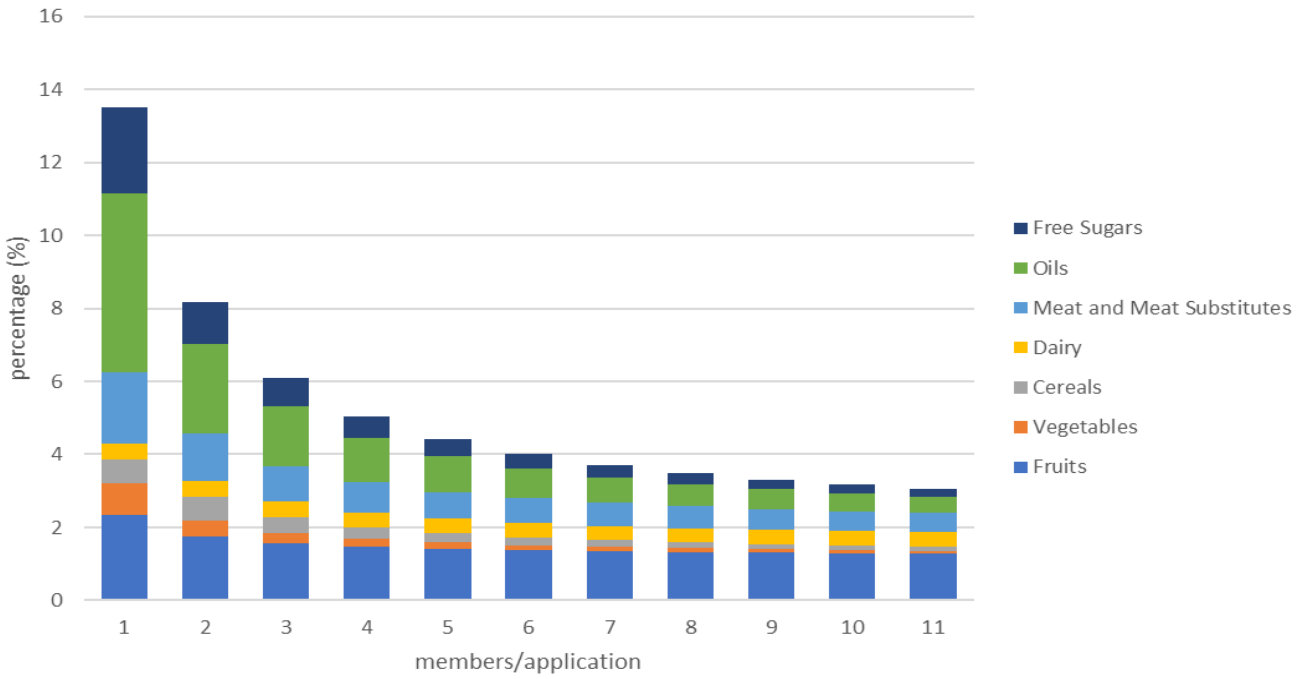

***Figure** 9 Proportion of daily recommended intake covered by the provided food aid by FEAD for each food group and according to eligible number of members per application.*

As the data unfolds, it is becoming clearer that there is great variability between one- and eleven- members applications (Figure 9). In general, the distribution among the food groups is not constant. More specifically, the nutritional contribution of Fruits is greater than the food group of Meat and Meat Substitutes, however, there seems to be a level of agreement in the way the foods are distributed between the beneficiaries. The same is, also, true in the case of Vegetables, Cereals and Dairy. However, regarding the group of Dairy the contribution is very small at any case. Oils and Sugars have the widest range, and therefore, for these groups, the alterability between the provided food aid and the members of each application is noticeable. This information is represented visually in Figure 9.

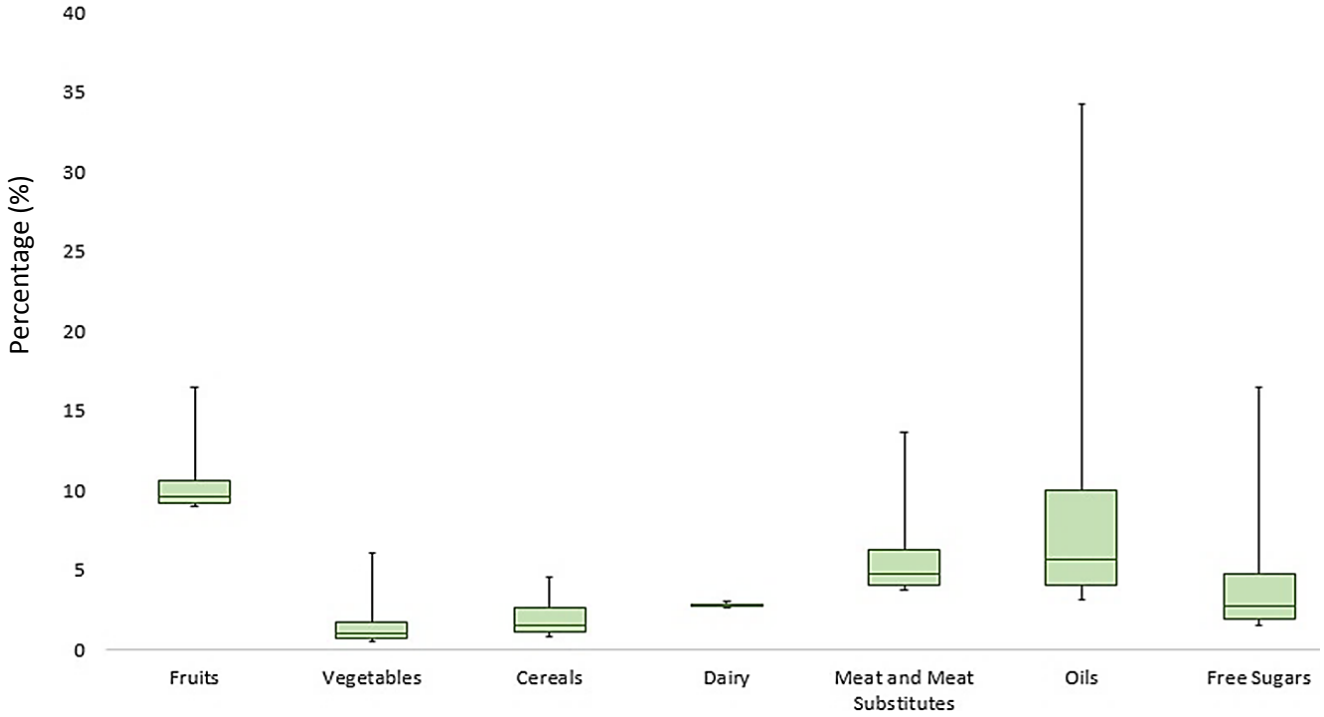

***Figure 10**: Range of recommended daily intake covered by FEAD provided food aid across all application sizes per food group.*

3.2.2. Analysis of Nutritional Contribution in Macronutrients

Apart from the food groups, for the Centralized Supplies the daily contribution of the provided foods in macronutrients for every member per application was calculated with the program **DietAnalysis Plus**. The macronutrient content of the foods, as well as the daily coverage per person and nutrient are presented in Tables 2 and 3. Table 3, also, includes the WHO nutritional recommendations per macronutrient.

The macronutrients analysis also showed a tendency for applications with a smaller number of members to benefit more from the food provision. More specifically, for applications with one member, the percentage of the daily contribution of the Centralized Supplies seems to be two times higher than applications with more members. In some cases, i.e. Dietary Fiber, Total Fat, Polyunsaturated Fat, Monounsaturated Fat and Saturated Fat, the contribution was even three times higher (Figure 11).

Table 3-2: *Levels of nutrients from the FEAD Centralized Supplies food provision on a daily basis for each application size (per person)*

Nutrient / # Members	Level of Nutrients										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Energy (kcal)	219.85	149.20	109.49	89.55	77.69	69.75	64.05	59.84	56.49	53.79	51.70
Protein (g)	6.79	6.01	4.56	3.83	3.40	3.10	2.90	2.74	2.62	2.52	2.44
Carbohydrate (g)	23.19	17.63	12.75	10.30	8.84	7.87	7.17	6.65	6.24	5.90	5.65
Dietary Fiber (g)	3.66	3.26	2.31	1.83	1.54	1.35	1.22	1.11	1.03	0.97	0.91
Total Fat (g)	11.48	6.37	4.67	3.81	3.31	2.97	2.72	2.54	3	2.28	2.20
Polyunsaturated Fat (g)	1.64	0.86	0.59	1.04	0.37	0.32	0.28	0.25	0.23	0.21	0.20
Monounsaturated Fat (g)	6.83	3.48	2.48	1.98	1.68	1.49	1.34	1.24	1.15	1.08	1.03
Saturated Fat (g)	2.27	1.38	1.15	1.04	0.97	0.92	0.89	0.86	0.84	0.83	0.82
Water (g)	51.23	36.16	32.41	30.53	29.40	28.64	28.11	27.69	27.39	27.13	26.93
Sodium (mg)	52.19	46.77	36.31	31.01	27.91	25.72	24.23	23.07	22.27	21.57	21.00

Table 3-3: *Percentage of recommended daily intake in macronutrients covered by the FEAD Centralized Supplies food provision on a daily basis for each application size (per person)*

Nutrient / # Members	Percentage of the Daily Coverage (%)											WHO Nutritional Recommendations (2015)[57]
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
Energy	9	6	4	4	3	3	3	2	2	2	2	2000 (kcal)
Protein	12	11	8	7	6	6	5	5	5	5	4	10%
Carbohydrate	7	5	4	3	2	2	2	2	2	2	2	>55%
Dietary Fiber	10	9	7	5	4	4	3	3	3	3	3	25 g
Total Fat	15	8	6	5	4	4	3	3	3	3	3	<30%, of which saturated <10%
Polyunsaturated Fat	6	3	2	2	1	1	1	1	1	1	1	
Monounsaturated Fat	24	12	9	7	5	5	5	4	4	4	4	
Saturated Fat	9	5	5	4	4	4	4	3	3	3	3	
Sodium	2	2	2	1	1	1	1	1	1	1	1	< 5 g

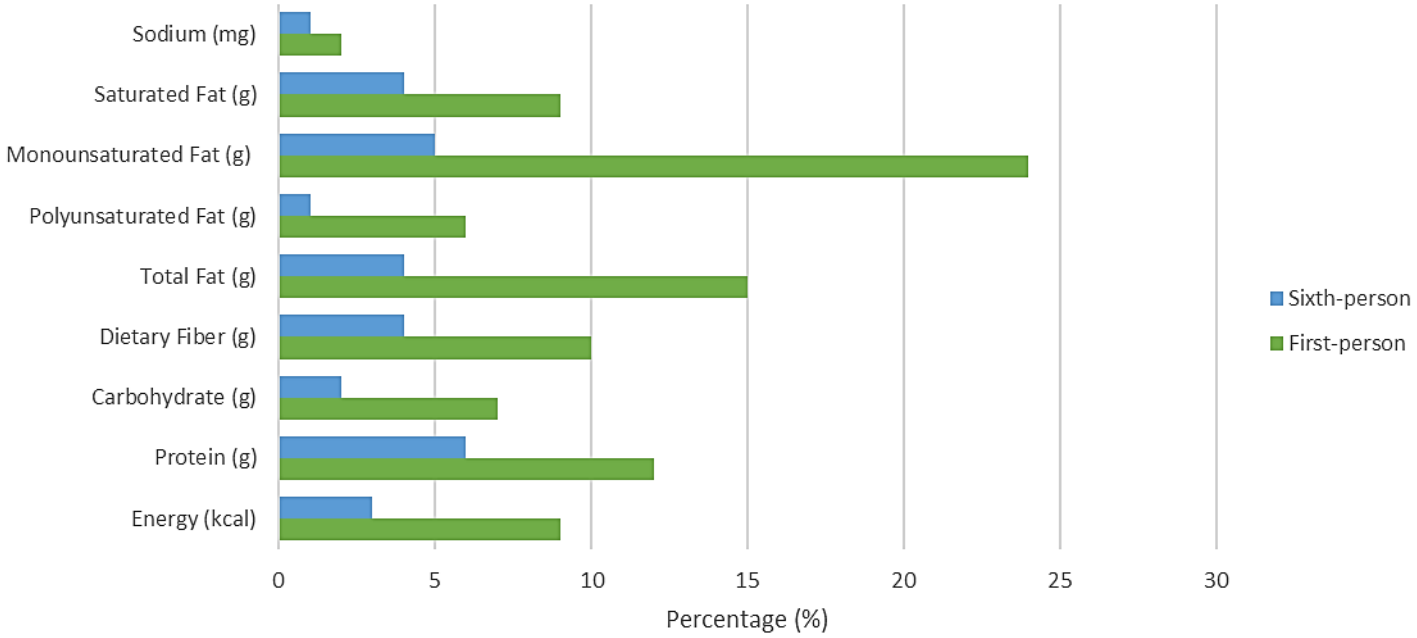

Figure 11 *Comparison of energy and macronutrients between a single member application and a six-member application (per person) covered by the FEAD Centralized Supplies food provision on a daily basis*

3.3. Decentralized Supplies

3.3.1. Analysis of Nutritional Contribution in Food Groups

The way the Program is implemented in our country, provides every Social Partnership with the flexibility of delivering its beneficiaries food products that have resulted from contests at a local level. This means that not all the partnerships deliver the same types of food (Appendix A). However, not all of them were active during the examined time period. The percentage of the daily contribution for a one-member application for the active social partnerships from January 2016 to December 2017 is presented in the figure below (Figure 12).

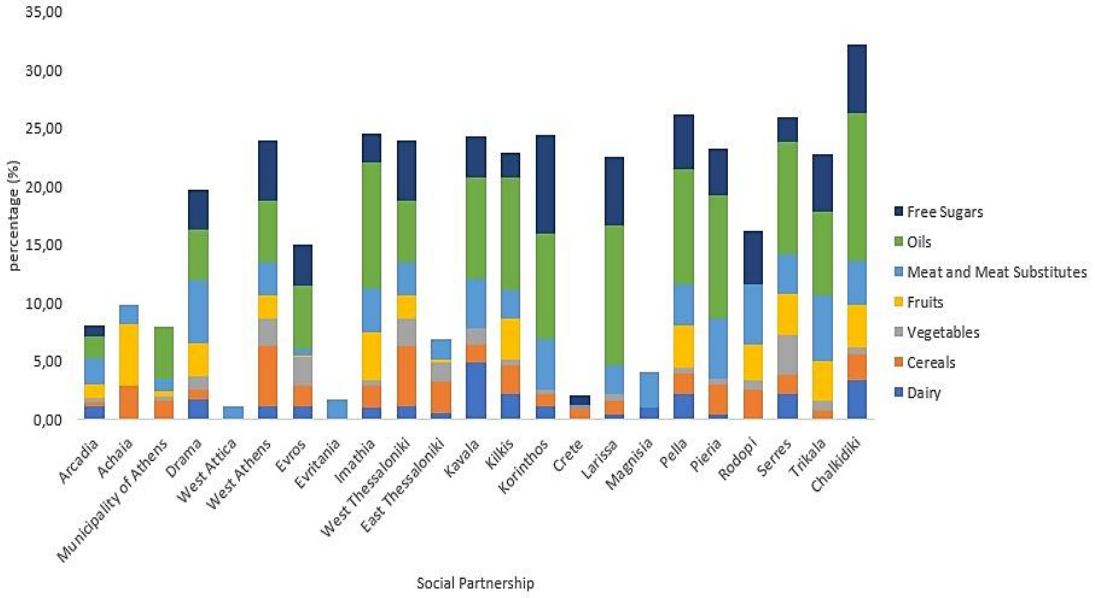

Figure 12: *Proportion of daily recommended intake covered by the provided food aid by the FEAD Decentralized Supplies for each food group (results for single member applications for each Social Partnership separately, January 2016 to December 2017)*

Moreover, the distribution among the food groups for the case of the Decentralized Supplies is, also, not constant. More specifically, the nutritional contribution of Fruits is approximately the same with the food group of Meat and Meat Substitutes, but they differ greatly from Vegetables, Cereals and Dairy. Oils and Sugars have the widest range, and therefore, for these groups, the alterability between the provided food aid in each Social Partnership is noticeable. This information is represented visually in Figure 13.

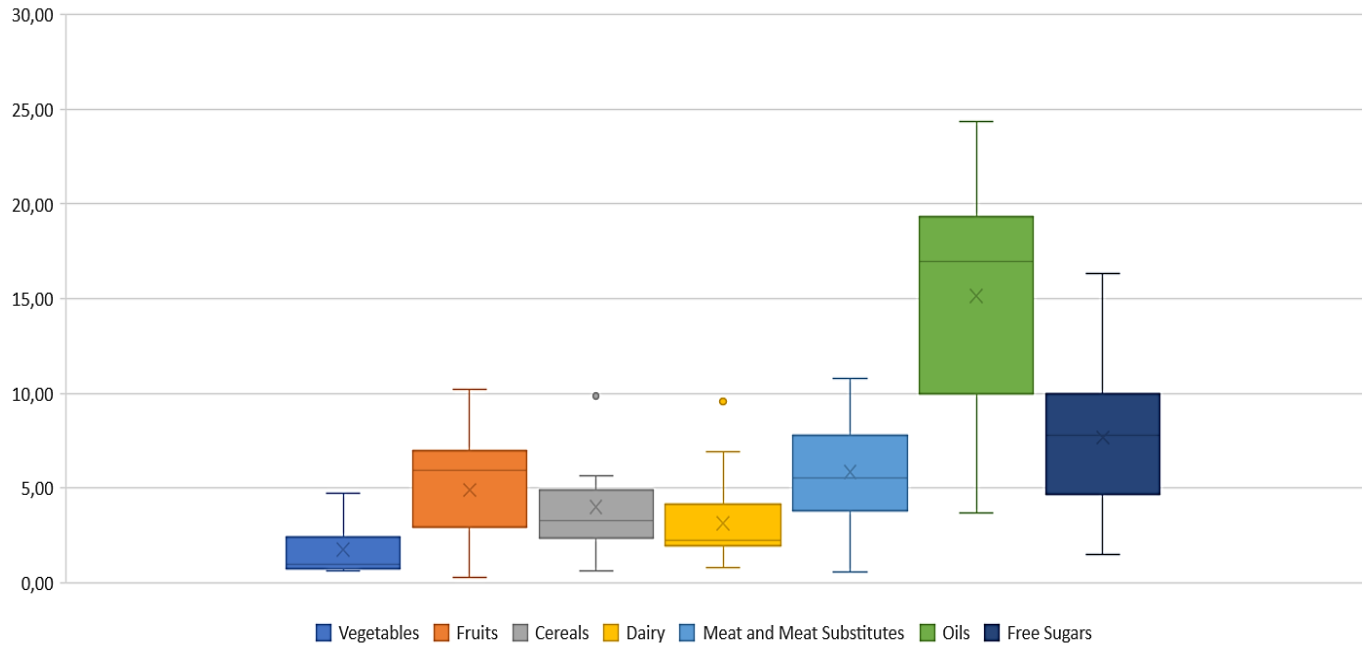

Figure 13: *Range of means of recommended daily intake covered by FEAD Decentralized Supplies provided food provision for all application sizes per food group.*

3.4. Total Contribution of FEAD

The total nutritional contribution of the food provision provided by FEAD is presented in the figure below (Figure 14). The group of Oils seems to be the one with the highest contribution percentage in any case (Centralized or Decentralized) (sum of means 24.55 %). Following that, is the group of Fruits with 15.37 %. Moreover, for the Free Sugars Group the nutritional contribution is found to be 12.17 % and for the Meats and Meat Substitutes 11.79 % of the beneficiaries' daily needs. At the same time, for the group of Cereals the rate is 6.08 % and the Dairy 5.96 % respectively. Finally, for the Vegetables the daily contribution is 3.39 %.

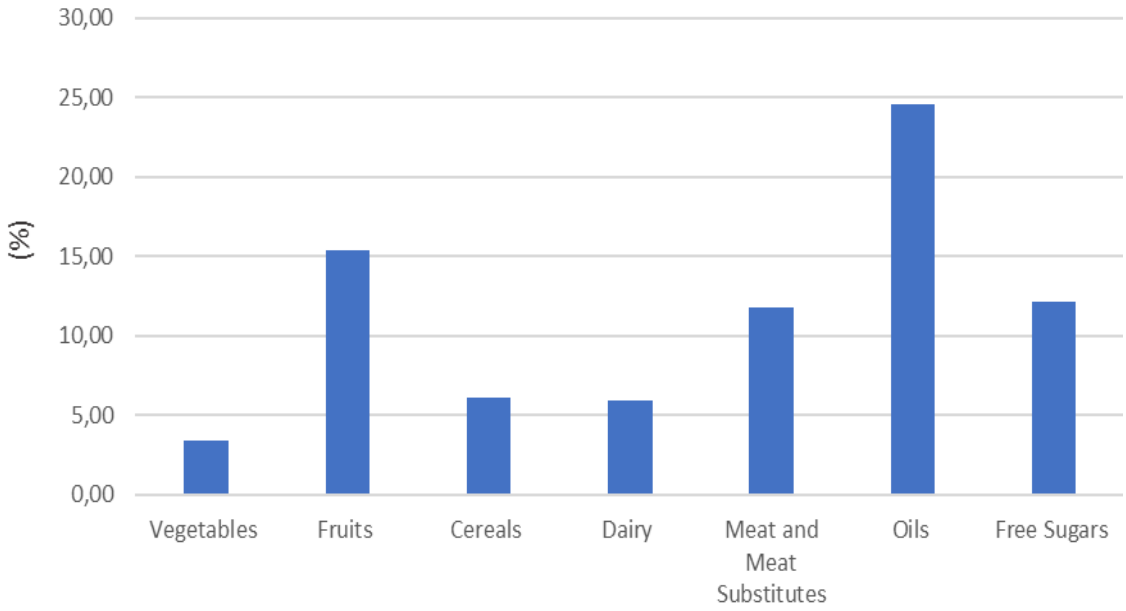

Figure 14: *Combined contribution of the daily recommended intake per food group for each beneficiary (sum of mean contribution of Centralized and Decentralized Supplies).*

4. Discussion

The *Fund for European Aid for the most Deprived* (FEAD) is a project that has been running for almost two years in Greece, with the main purpose to provide material assistance to people living in the brick of poverty. This study is the first attempt for a simulation and computational approach of the nutritional evaluation of the FEAD Program in Greece. It provides us with valuable information about the implementation of this policy, helping us address its strengths and weaknesses, and an insight of its effectiveness.

Generally, the evidence that this study provided us is that there are large variations in the amount of coverage of daily needs between the food categories and the size of the household per application. Regarding the Centralized Supplies, single-person applications received double the amount of supplies in vegetables, meat, oils, and free sugars even from a two-persons application. The difference grew bigger as the size of the household increased, always in favor of the single-person applications. More specifically, the Centralized Supplies cover less than 20% of the daily needs of the participants, with the exception of the food group of Oils (34%) for single-person households. It is worth mentioning the fact that the quantity of the provided food has already been criticized for not offering sufficient food to a family for every day of the year, in the Midterm Evaluation Report of the Program. However, according to that, FEAD is supposed to adding to existing initiatives, and not overlapping them.[21] Moreover, the contribution of vegetables, cereals and dairy seem to be very low in all types of applications. These results are also confirmed with the macronutrients analysis. For every macronutrient the daily contribution doesn't exceed 15% of the daily recommendations, apart from the monounsaturated fats for one-person applications.

The case of the Decentralized Supplies is more complicated because of the great variability among the food types delivered to the participants of the program between the different regions of the country, without any specific pattern though. Specifically, this alterability is noticeable among the decentralized supplies with some partnerships delivering foods aid from a single food group in a full year (n=2/23), while others delivered all seven food groups (n=10/23). Despite all these differences between the partnerships, it seems that the contribution in the food groups of oils and free sugars are similarly high to the Centralized, as well as the groups of fruits, meat and meat substitutes, and vegetables which seem to be the ones with the lowest percentage in the coverage of the daily needs. If Centralized and Decentralized Supplies are summed up, the daily contribution of the program doesn't exceed 16% of the recommended intake for most of the food groups, with the exception of the Oils (24.5%).

The dietary habits and choices of people with low income and people living in the brick of poverty have been previously recorded. A review study found that individuals with higher income were more likely to have lower stress levels, healthier eating

patterns, and lower body weight, whilst lower income individuals, who had higher levels of stress, were more likely to have less healthy dietary behaviors and higher body weight.[58] Moreover, a study of French adult population has also revealed that higher dietary energy density (e.g. low cost energy-rich starches, added sugars, and vegetable fats) was associated with lower diet cost.[59,60] Certainly, there are plenty of factors that need to be taken in consideration which help shape this kind of dietary habits such as limited or absent kitchen facilities, cooking skills, money or time.[60] The objective of every Food Assistance Program is to alleviate the effect of food insecurity on vulnerable populations and help them take a step towards improving their health and well-being, and reducing inequalities. Consequently, the Fund for European Aid for the most Deprived being such a program should contribute to the fight against food insecurity through the food assistance. However, the results provided by this study raises some questions about the quality of the provided food aid.

First of all, the *World Health Organization* recommends that fat consumption should not exceed 30% of the total energy intake. Specifically, unsaturated fats (e.g. found in fish and olive oil) are preferable to saturated fats (e.g. fatty meat, butter), while industrial trans fats (e.g. processed food, margarines and spreads) are not part of a healthy diet.[57] The food group of Oils in this study seems to be the one with the higher contribution rate (24.5%) at any case. Having mentioned the above, it would be safe to suggest that even though most of the provided fats are olive oils, a better distribution among the end recipients of the program regarding the share of the portions. Furthermore, WHO suggests limited intake of free sugars (less than 10% of total energy intake) as part of a healthy diet, with a further reduction to less than 5% of total energy intake for additional health benefits[57]. Consuming free sugars increases the risk of dental caries (tooth decay)[61] and contributes to unhealthy weight gain, which can lead to overweight and obesity.

On the other hand, numerous studies have been conducted indicating that the regular consumption of fruits, vegetables, whole grains, and other plant foods has been negatively correlated with the risk of the development of chronic diseases and cancer at several sites.[62,63] Eating at least 5 portions of fruits and vegetables per day reduces the risk of Non-Communicable Diseases (NCDs) and helps ensure an adequate daily intake of dietary fiber.

An additional issue that raises further discussion is the success of these kind of food policies. There have been a lot of contradictions regarding the implementation of programs providing food aid to people in need with problems mainly being focused on disincentive effects of production, disruption of markets and poor targeting. An analysis about food aid policies in India and Bangladesh have been found to be generally positive, though development and food security outcomes have been less encouraging in Ethiopia and Zambia.[64] Findings of another study on elderly population concerning the effect of their participation in Food Assistance Programs on their weight implied that food insecure elders who participated in food assistance programs

were less likely to be overweight and depressed than those who did not. This fact highlights both nutritional and non-nutritional impacts of these kind of programs.[65]

The Supplemental Nutrition Assistance Program (SNAP) is one of the most famous and most widely studied Food Policies in the United States of America, and in general. SNAP is a food assistance program that has had a special impact on the American vulnerable population. Even though, it is not considered a direct food aid program like FEAD, a literature review regarding its contribution as a different approach in addressing the problem of food insecurity, is very useful. A lot of research has been carried out in order to specify the dietary quality of the program, its effectiveness in terms of its objectives and the opinion of the participants about it.

As far as the dietary quality goes, SNAP participants can use their benefits to purchase most items intended for human consumption including kinds of sweet pastries apart from for items such as alcoholic beverages, tobacco and vitamins.[66] Evidence has been found that long term SNAP participants tend to have higher Body Mass Index (BMI) among specific groups (girls aged < 12 years, young daughters of obese mothers, and preschool children living in cities with high food prices).[67] Because of that, there have been some efforts to put focus on healthful foods, using financial incentives. One of them was the Healthy Incentive Pilot program in 2011, through which every dollar that SNAP participants spent on targeted fruits and vegetables yielded 30 cents in additional Electronic Benefit Transfer credit.[68] This program was successful regarding the increase in the purchase of these types of food (about 26%), however the results showed that the combined effect of nutrition education with a financial incentive program could provide more valuable outcomes.[68]

SNAP effectiveness in increasing food security has also been studied. Both significant and no significant associations have been found. For example, J. Mabli and J. Ohls found that SNAP participation reduced food insecurity by 6% in their cross-sectional sample and 17% in their longitudinal sample.[45] Another study has found that every additional SNAP dollar, per person, decreases the possibility of food insecurity by about 0.3 to 1%.[69] Moreover, the analysis of data from households receiving raised SNAP benefits showed increases in food expenditures and decreases in levels of food insecurity, and also indicated improvements in dietary quality among school-aged children.[70] On the other hand, there are parts of the past literature have failed to find any clear [71] or even positive associations between SNAP and food insecurity.[72]

Being such a large program, SNAP has people with various stakeholder interest in it, who view the existing policy from different aspects. SNAP participants are a group of stakeholders whose opinion is very important regarding the optimization of the program. A study about the perspective the beneficiaries have on the available foods from the program has shown that they are supportive of excluding sugary beverages as long as there are inducements related with healthful foods such as fruits and vegetables [73]

Our study being a computational estimation can be used for comparison between different food assistance policies. Through this procedure, we can understand and address the strengths and weakness of the program being studied. It provides us with valuable material for suggestion making towards improvements. Additionally, in terms of the significance of such simulation studies they can be used as a helpful tool in bridging the gap between research and policy, either prior to intervention testing or in situations where intervention studies are not feasible.[74] Dietary simulation models have various forms in which a range of dietary strategies or scenarios can be tested or compared and predictions via mathematical equations regarding the hypothetical changes in dietary intakes can be made.[75] These kind of analyses can provide important information to guide policy-based decisions on effective health resource utilization, for example what dietary strategies or nutrition messages may be effective to take forward in development or testing of public health campaigns.[74]

Therefore, based on the evidence provided by the present study, some suggestions to improve the way the FEAD program is implemented in Greece can be made. Primarily, there is a need for redesigning the algorithm used for calculating the quantities of the provided food, so that there is a more relative rate between the number of beneficiaries and the total amount of food per application. Additionally, another improvement could be the creation of a detailed list of foods that ensures the diversity and nutritional value of the foods and follows the national nutritional recommendations and its integration into central and decentralized supplies. Another suggestion regarding the implementation of the FEAD could be the establishment of a procedure in order for FEAD to harness local crop and livestock production to ensure diversity, seasonality and value for money in the kind of foods it distributes.

5. Limitations and Future Research

Although the research has reached its aims, there were some inevitable limitations. First of all, this study is a simulation which provides us we valuable information about the Program but it is still a theoretical approach of the evaluation. Second, due to continuous change in the number of beneficiaries and confidentiality reasons, the categorization of the population according to age and sex wasn't applicable, so the assumption that the daily consumption is 2000 kcal, according to WHO recommendations, was made. Since there is a difference between the recommended portions and the regulated ones in Greece, and we have no information about which one was used for the OG, the portion sizes, that were used for the analysis, were the ones defined by WHO.

It is important to mention that even though the problem of food insecurity among the Greek population has been recognized, FEAD as a food assistance program, has no information on the nutritional needs of the beneficiaries. This fact leaves space for further research that would map the needs of the beneficiaries and evaluates them on a regular basis, ideally annually, at the level of eating habits, serious nutritional deficiencies, and on a personal level with the main focus being on what types of food they have access to, based on their income.

6. Conclusions

Given the inherent difficulties in the way the program is implemented in Greece, the conclusions of any single analysis cannot be taken as definitive. Still, this study provides a first insight of the contribution of the first food aid program coordinated at national level in our country. The setup of FEAD at the time of the analysis, showed a relatively small contribution of the program to the dietary needs of the beneficiaries (less than 16%) with great potential for inequalities. These inequalities are skewed towards large households and have an inconsistent geographical pattern (potentially linked to the program's execution per social partnership). Similar disparities are seen in the food group level and are augmented with the increasing volume of food provisions. There is potential for a review of the existing guide to improve the program nutritional impact.

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8. Appendices

8.1. *APPENDIX A- FOODS PROVIDED BY FEAD PROGRAM*

Table A-1 *Foods Provided by Centralized and Decentralized Supplies of FEAD and the proportion of the Social Partnerships who gave these foods*

	Foods Provided by the Centralized Supplies	Percentage of the Social Partnerships which gave these foods	Foods Provided only by the Decentralized Supplies	Percentage of the Social Partnerships which gave these foods
Fruits	Oranges	35%	Kiwi	4%
			Peach	4%
	Apples	39%	Stewed Fruit	30%
			Marmelade	30%
Vegetables	Cabbage	17%	Carrot	4%
			Zucchini	9%
	Concetrated tomato juice	56%	Tomato	4%
			Eggplant	4%
			Onion	4%
Cereals	Spaghetti	83%	Rice	39%
			Flour	43%
			Cornflakes	26%
			Potato	17%
			Dry bread	4%
Dairy	Feta Cheese	70%	Cheese	39%
	Evaporated milk	70%		
Meat and Meat Substitutes	Chicken	43%	Turkey	4%
	Boneless Pork	70%	Chicken Soup	26%
	Boneless Beef	78%		
	White dry beans	70%		
	Lentils	65%		
Oils	Olive Oil	48%	Margarine	4%
			Sun oil	26%
			Olives	26%
Free Sugars	Sugar	52%	Honey	30%

8.2. *APPENDIX B- FIGURES REPRESENTING THE RANGE OF EVERY FOOD GROUP BY THE PROVIDED PROVISION FOR EVERY ACTIVE SOCIAL PARTNERSHIP*

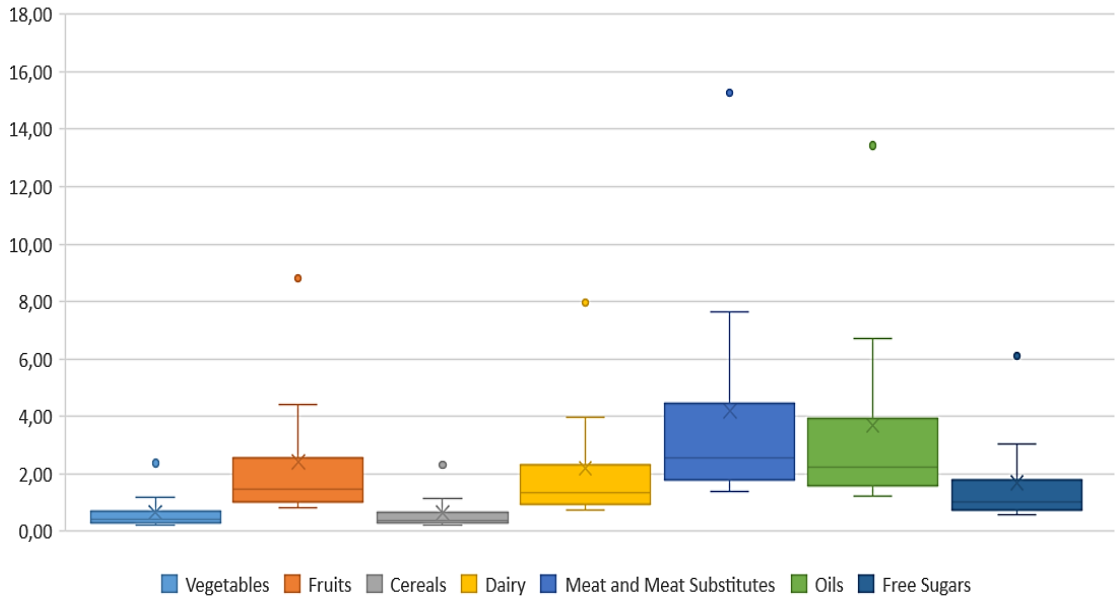

Figure B-1: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Arcadia, Greece.***

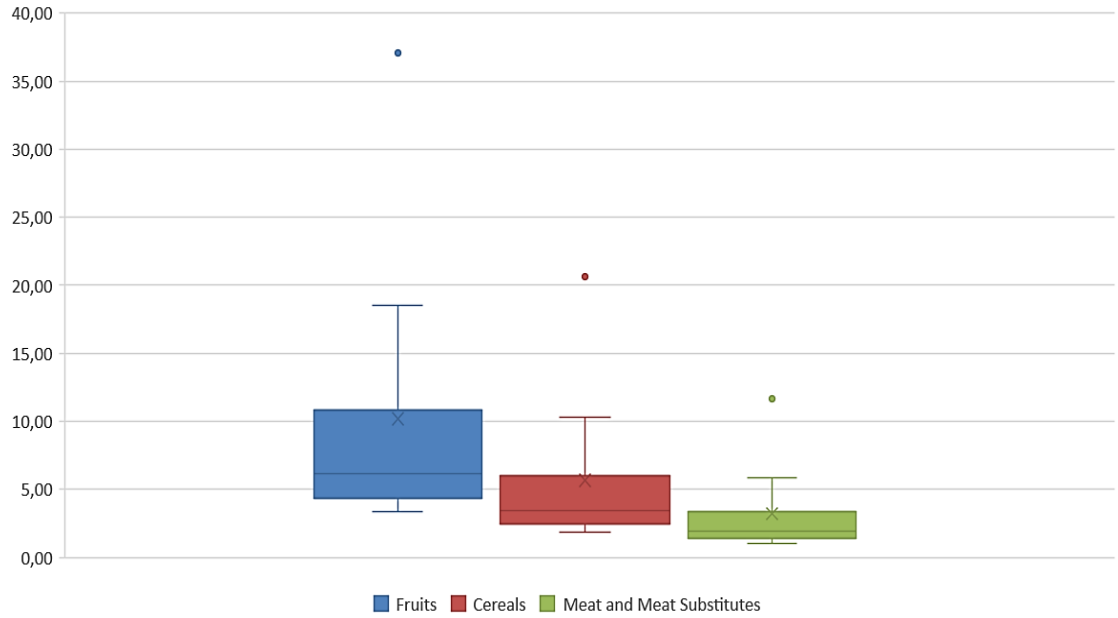

Figure B-2: *Box- plot representing the range of the daily coverage per food group for* ***the Social Partnership of Regional Unit of Achaia, Greece.***

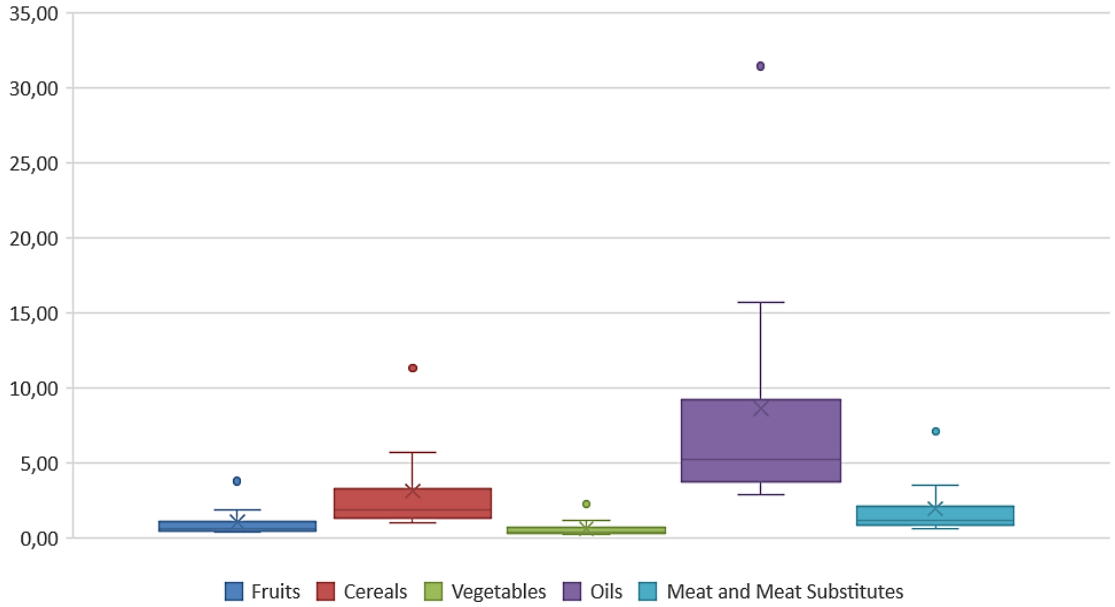

Figure B-3: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of the Municipality of Athens, Greece.***

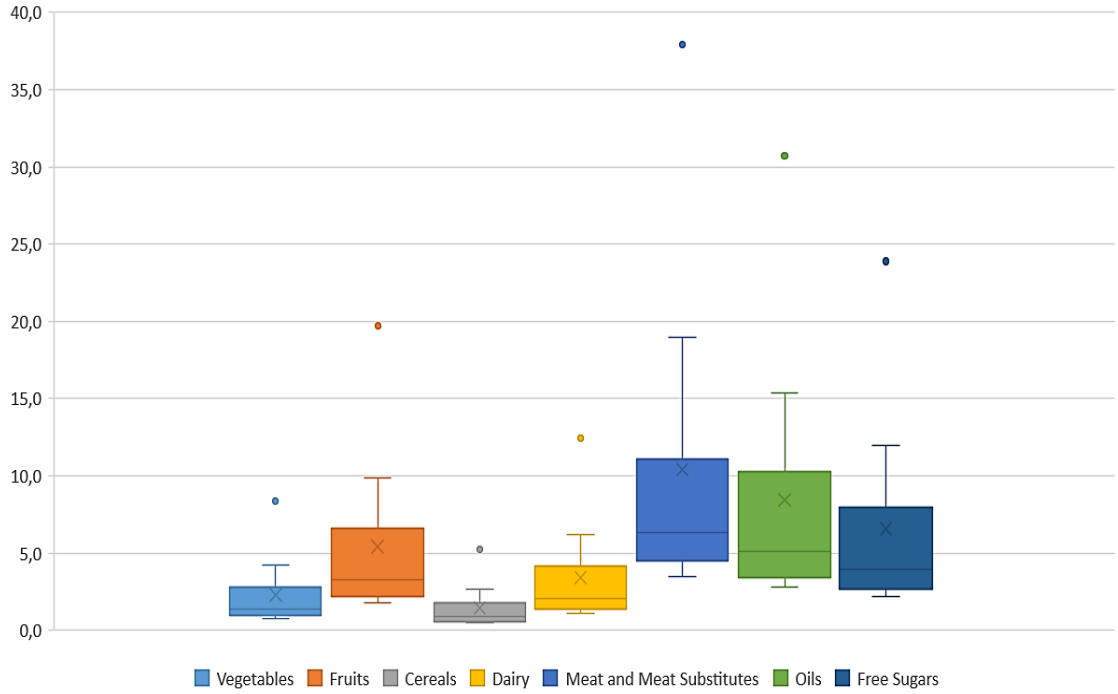

Figure B-4: *Box- plot representing the range of the daily coverage per food group* ***for the Social Partnership of Regional Unit of Drama, Greece****.*

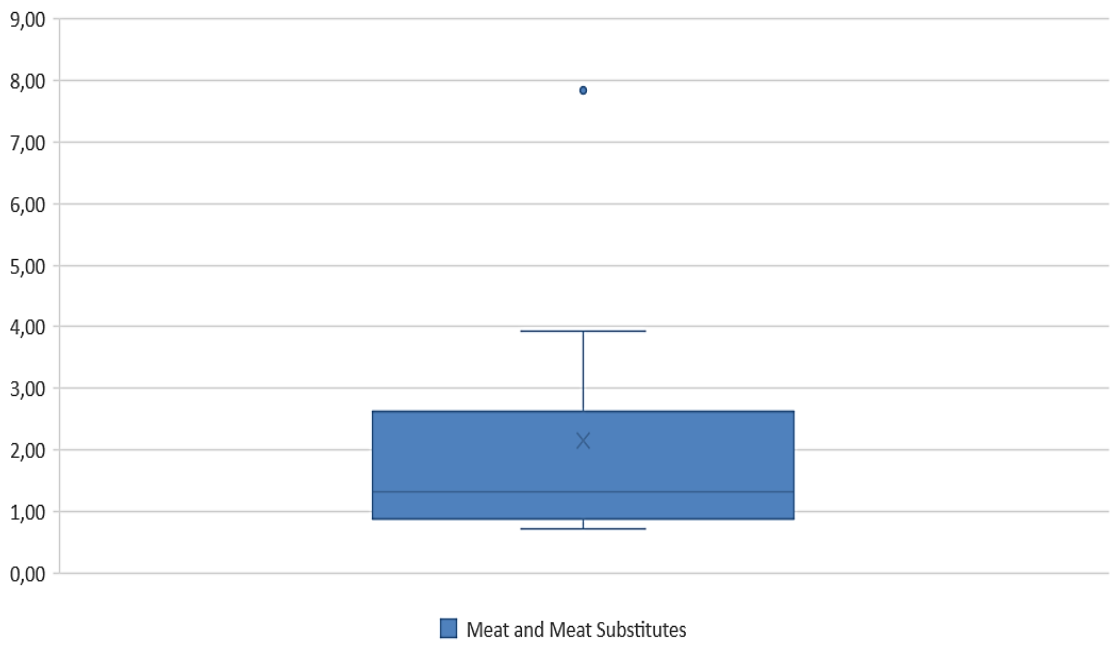

Figure B-5: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of West Attiki, Greece****.*

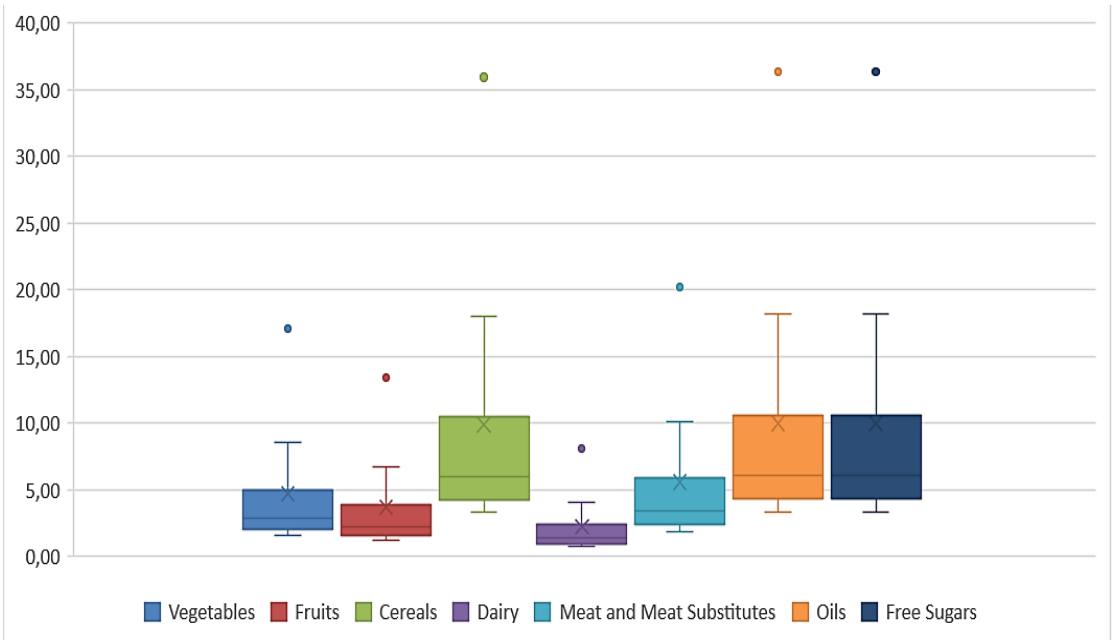

Figure B-6: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of West Athens, Greece****.*

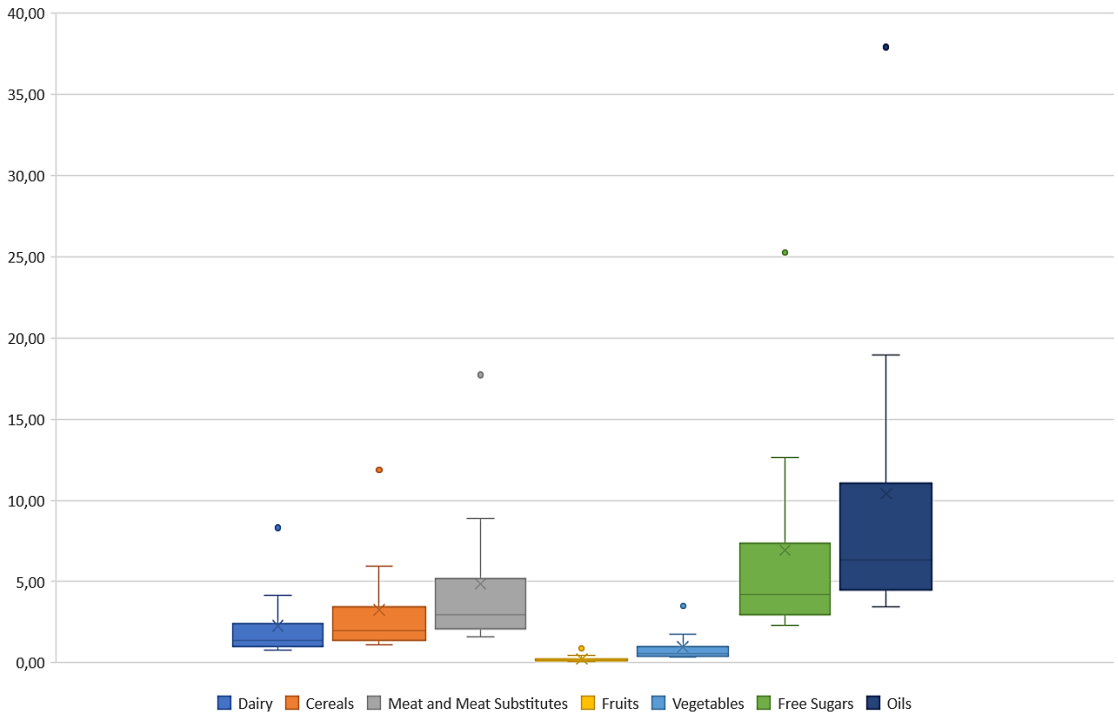

Figure B-7: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Evros, Greece***

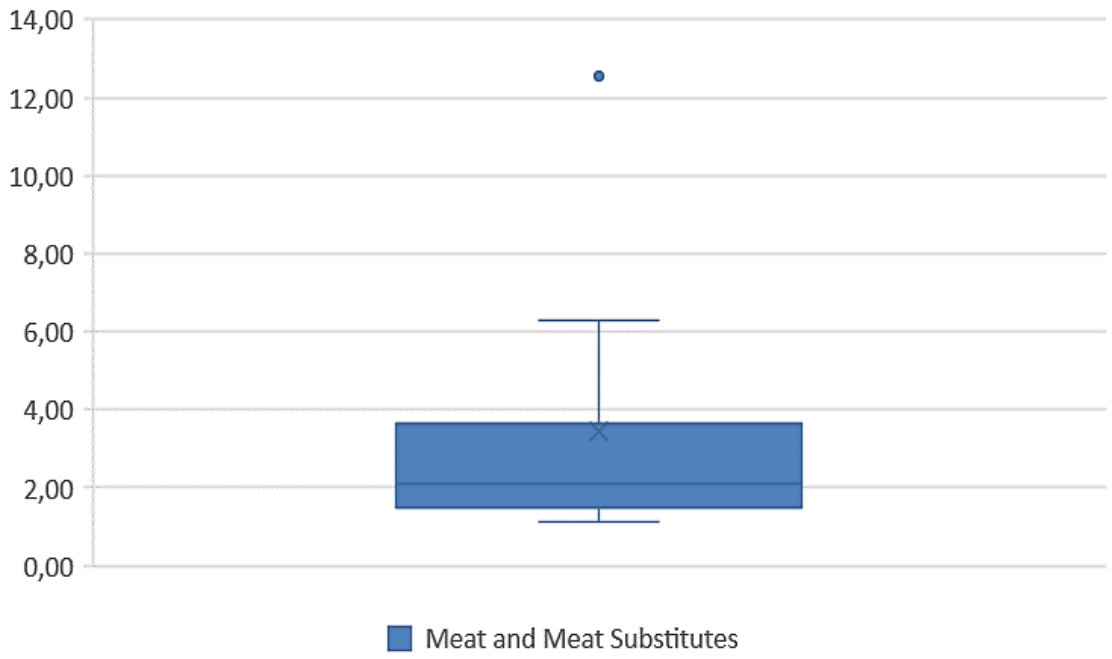

Figure B-8: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Evritania, Greece****.*

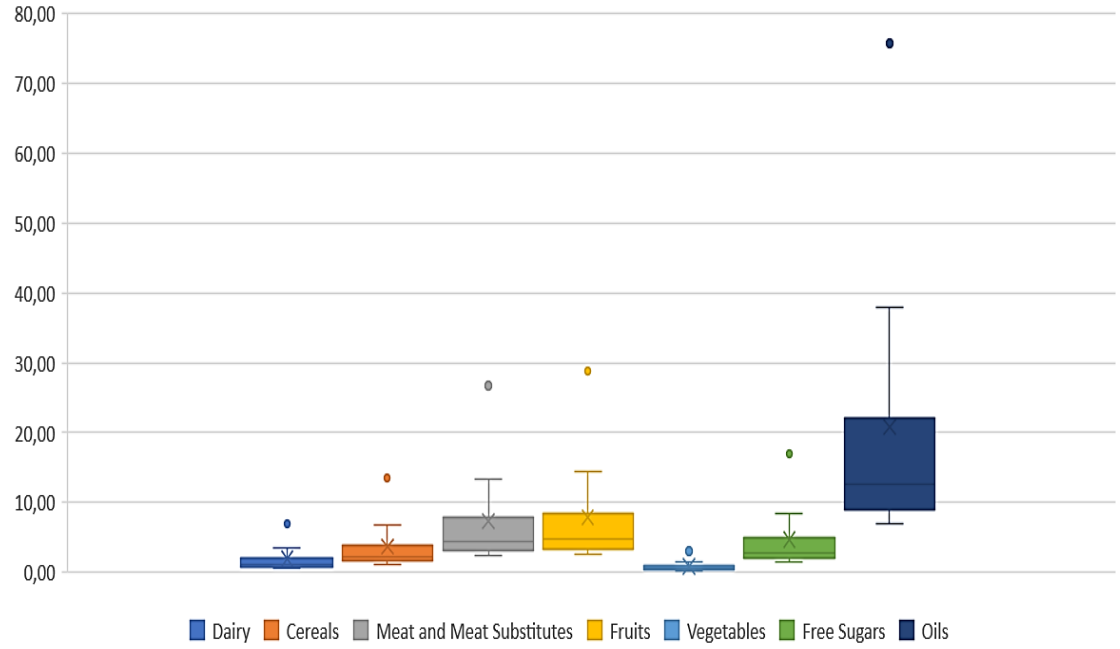

Figure B-9: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Imathia, Greece.***

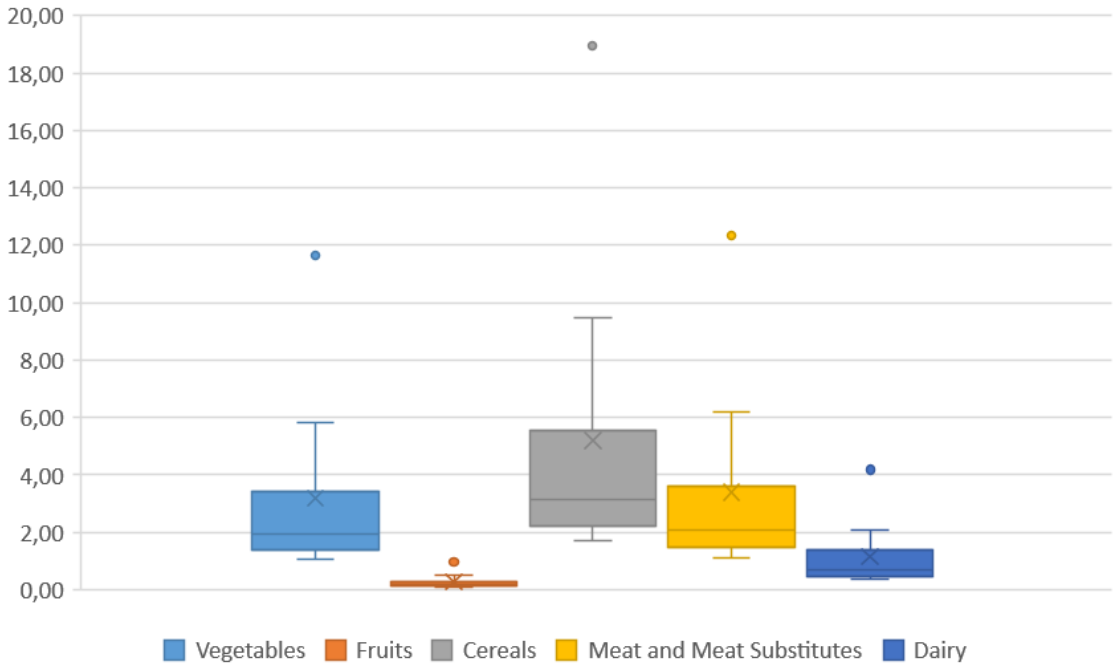

Figure B-10: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of East Thessaloniki, Greece*****.**

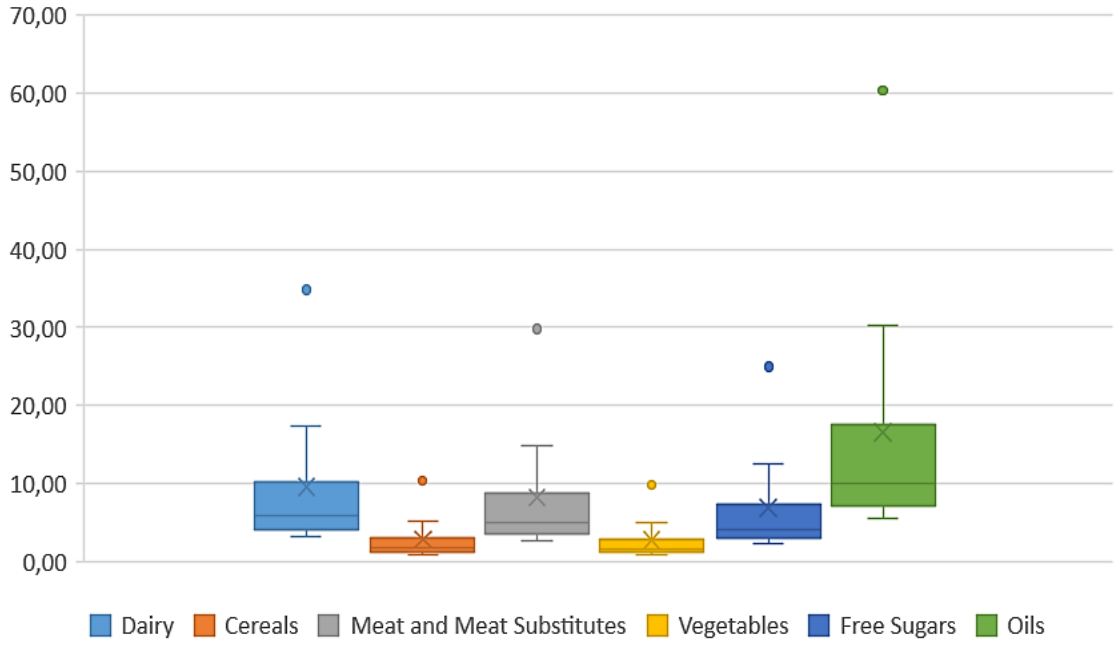

Figure B-11: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Kavala, Greece.***

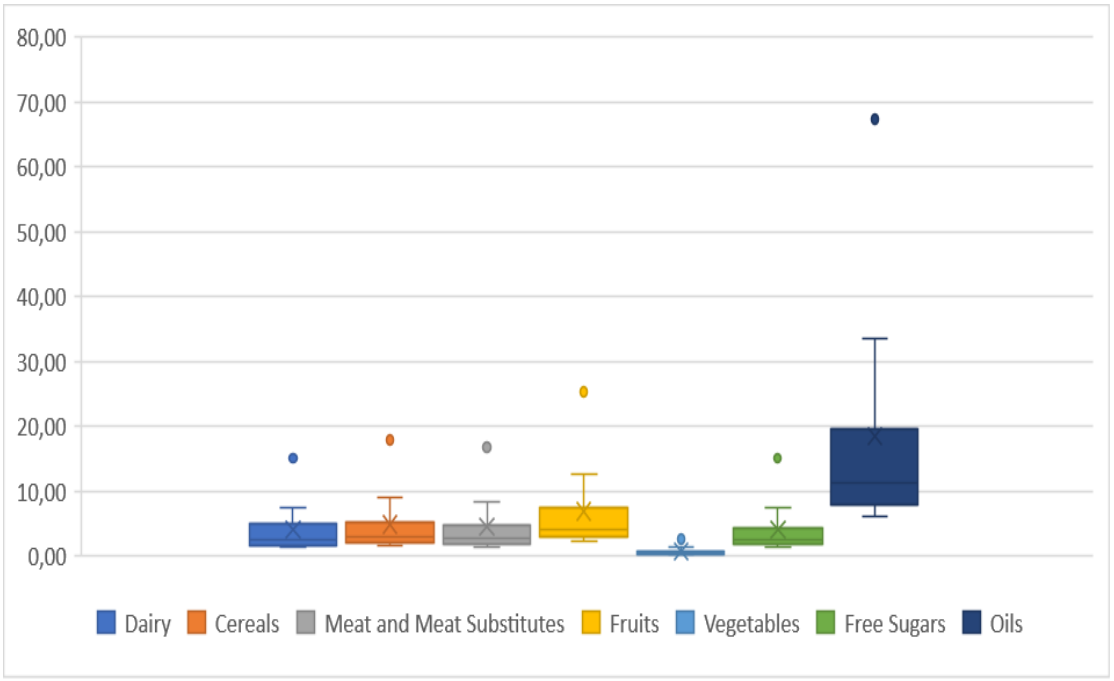

Figure B-12: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Kilkis, Greece****.*

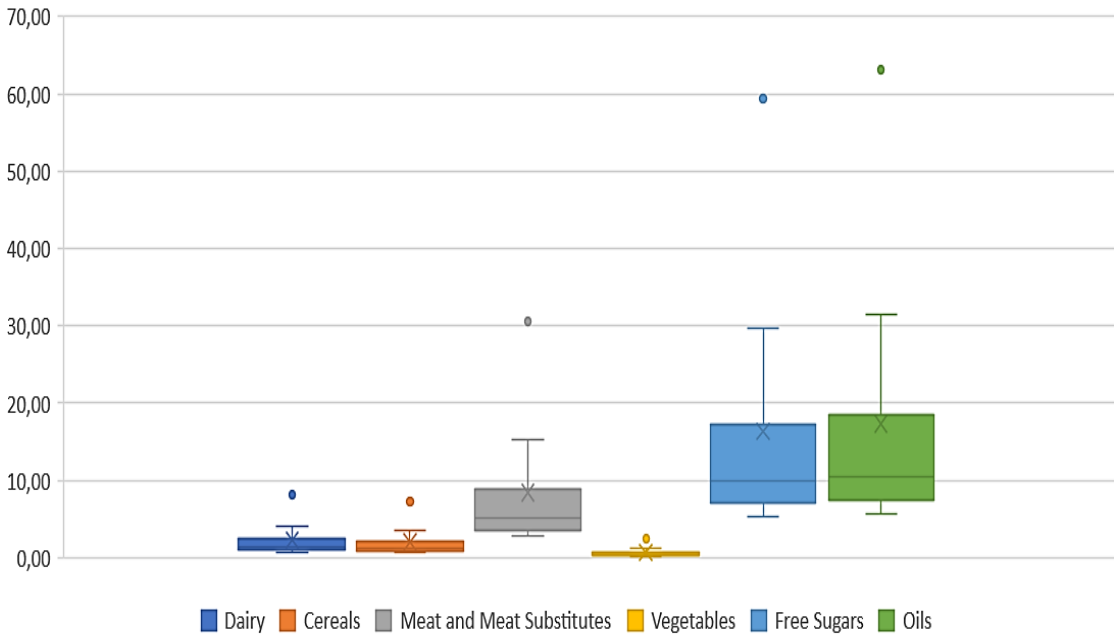

Figure B-13: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Korinthos, Greece****.*

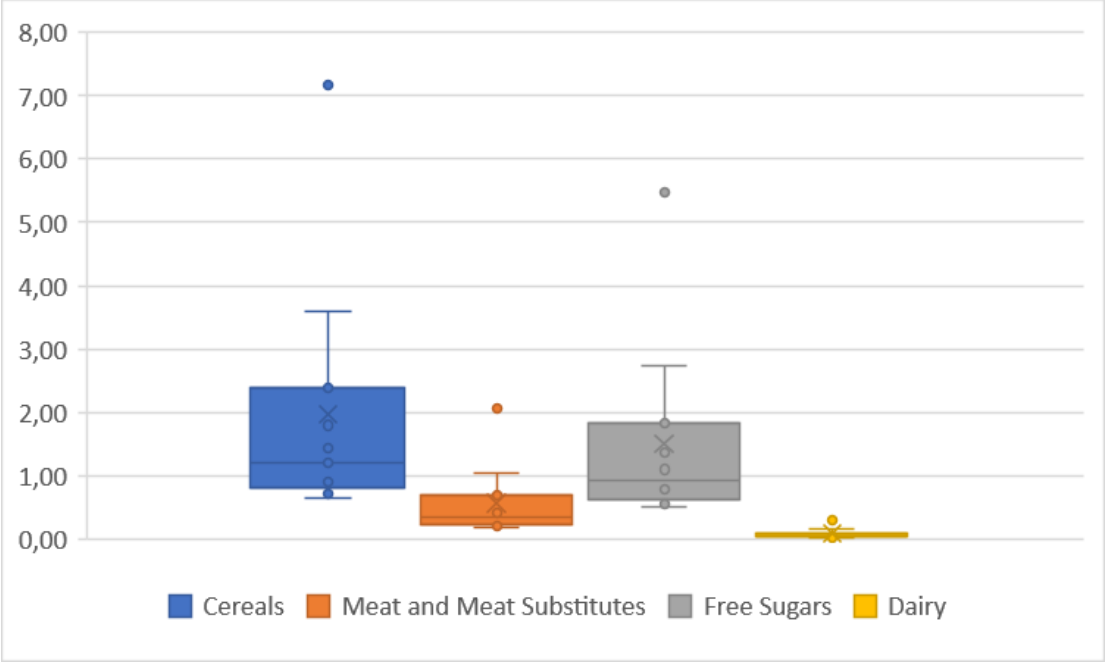

Figure B-14: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Crete, Greece****.*

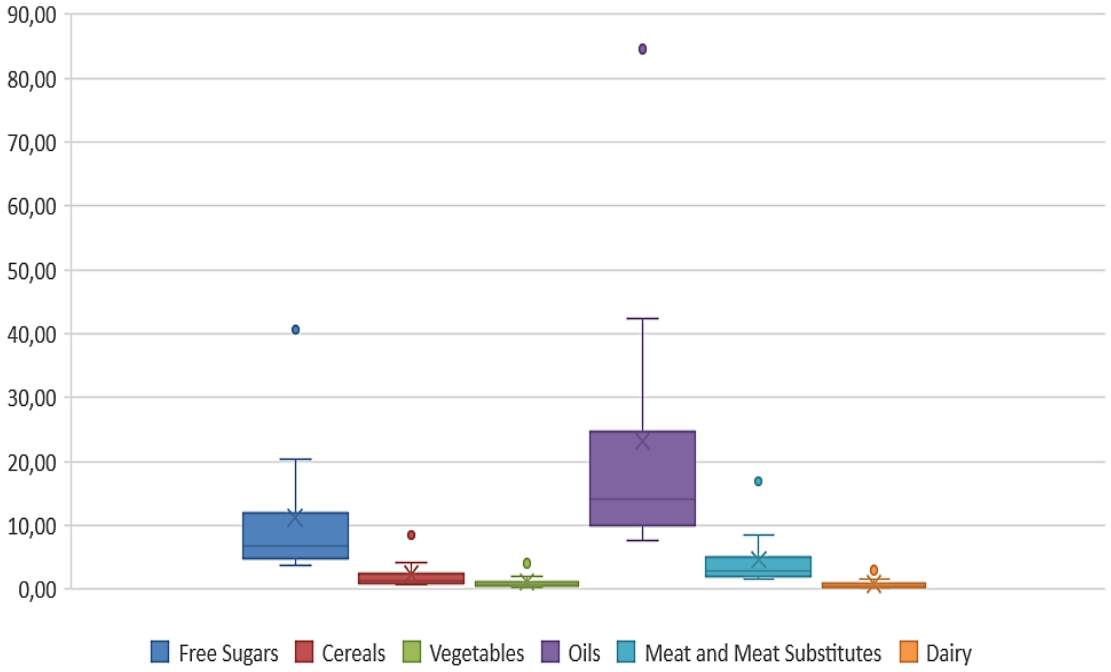

Figure B-15: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Larisa, Greece.***

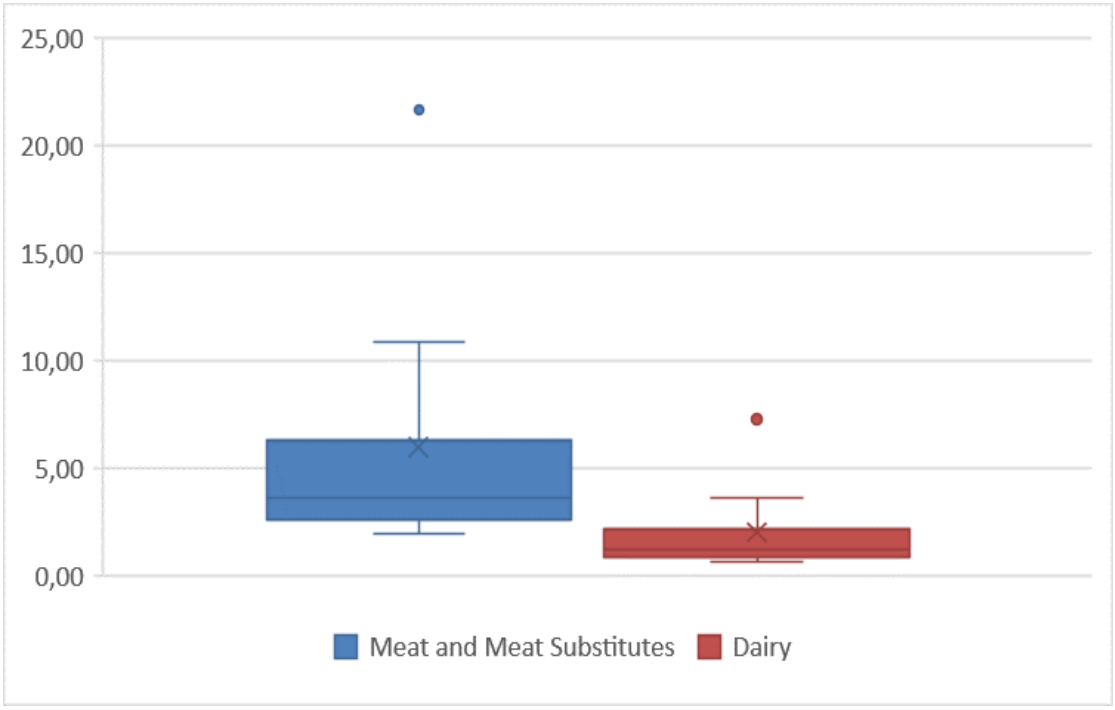

Figure B-16: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Magnisia, Greece.***

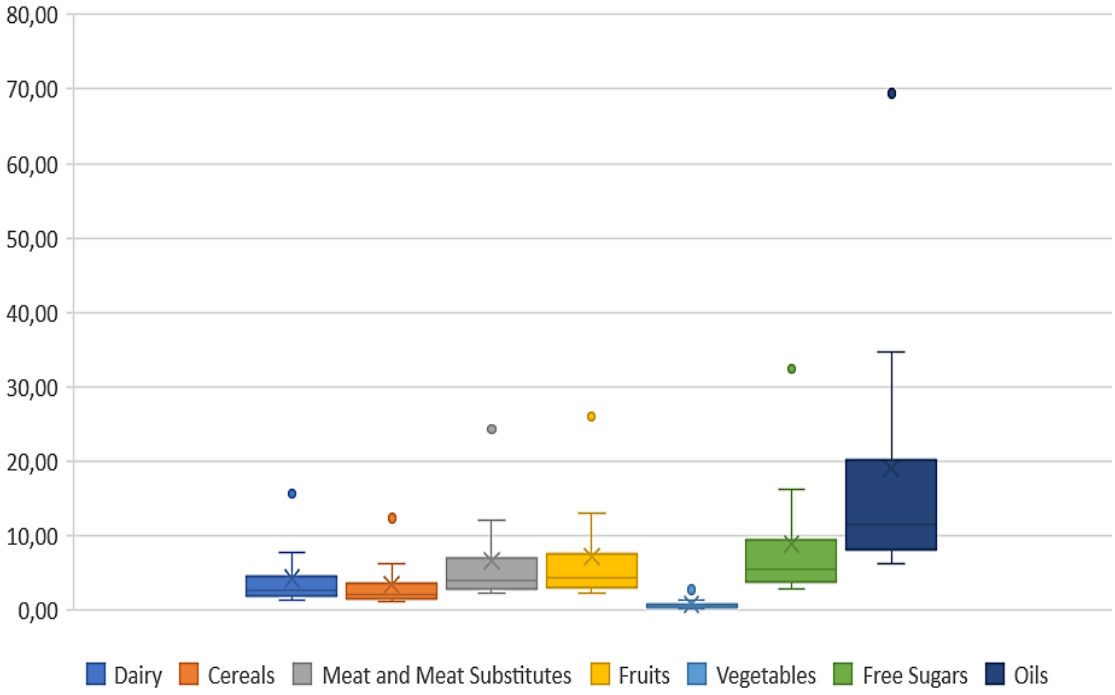

Figure B-17: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Pella, Greece.***

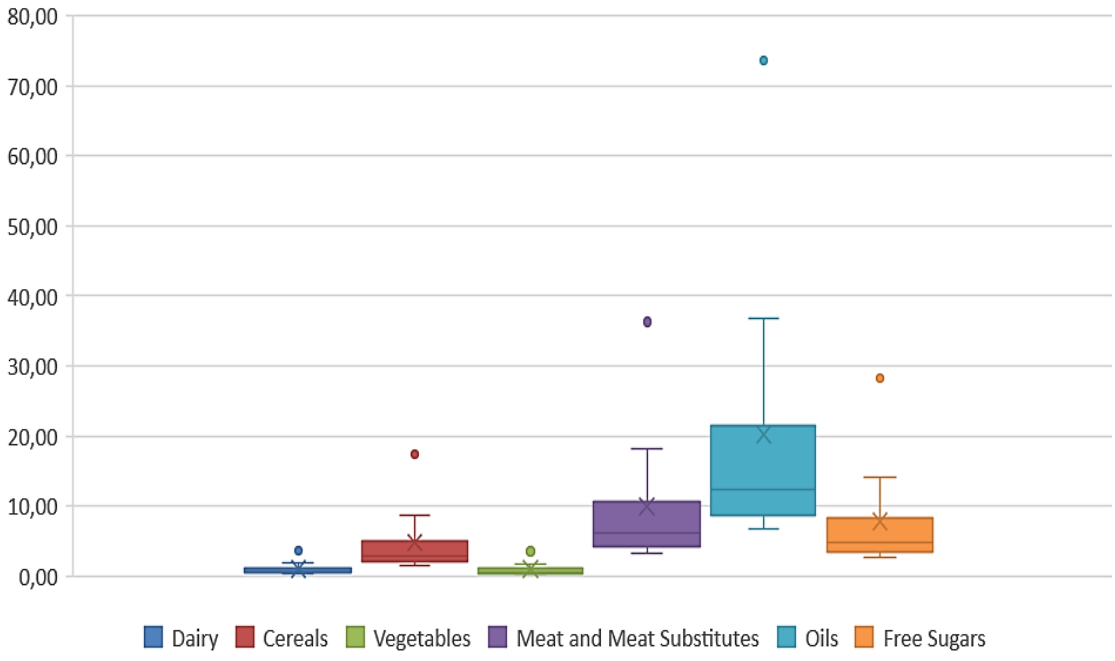

Figure B-18: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Pieria, Greece.***

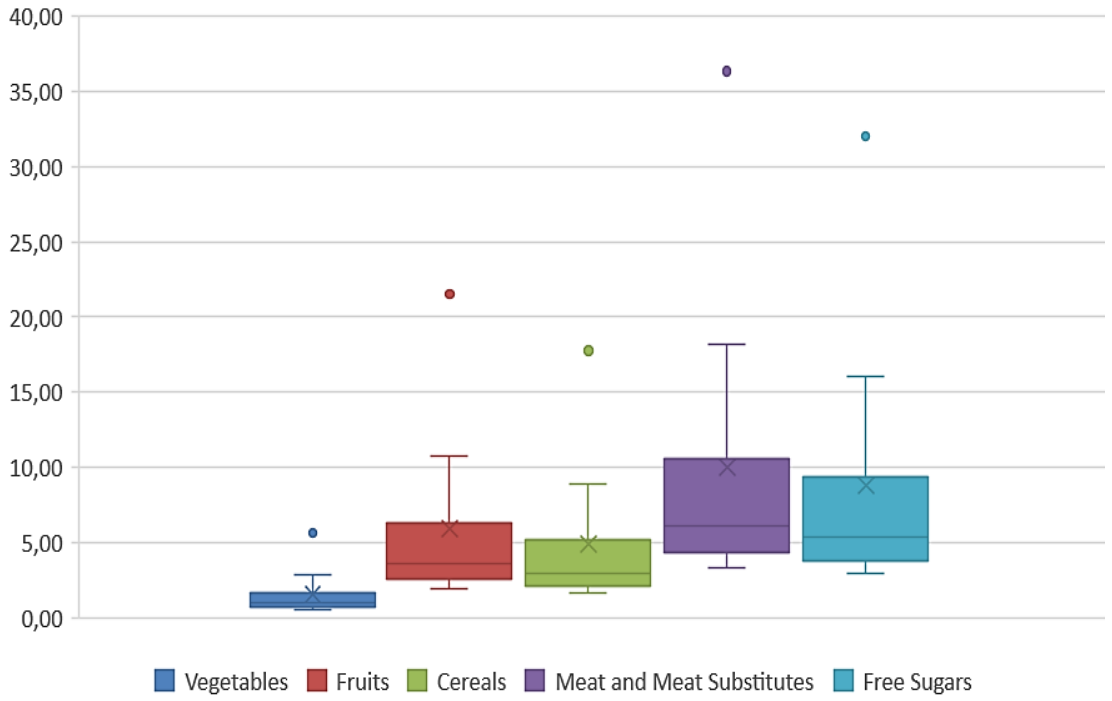

Figure B-19: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Rodopi, Greece.***

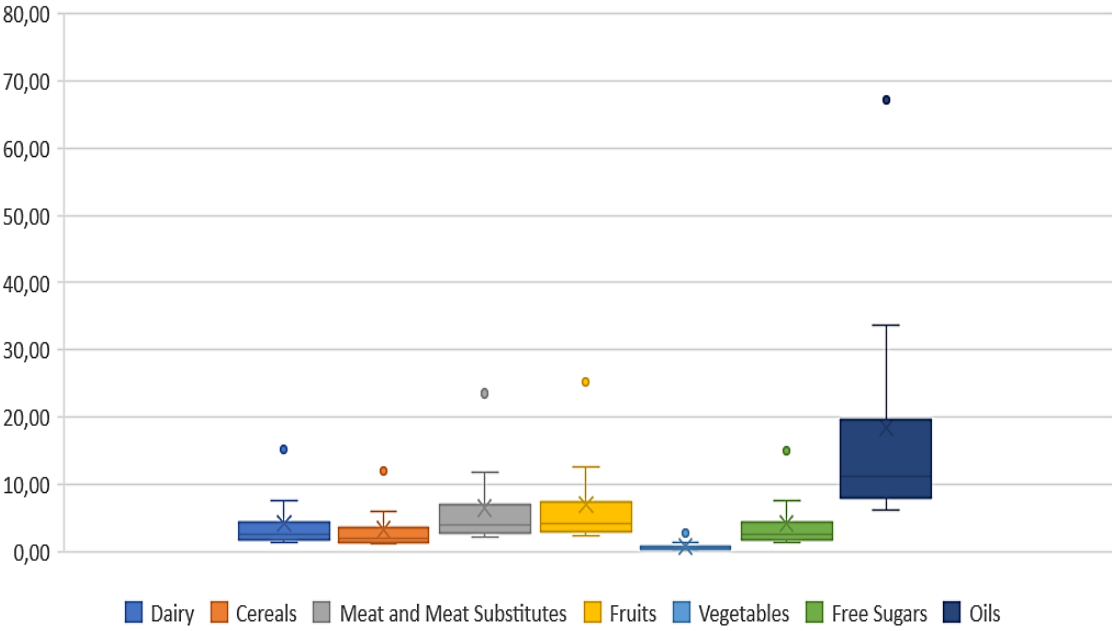

Figure B-20: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Serres, Greece****.*

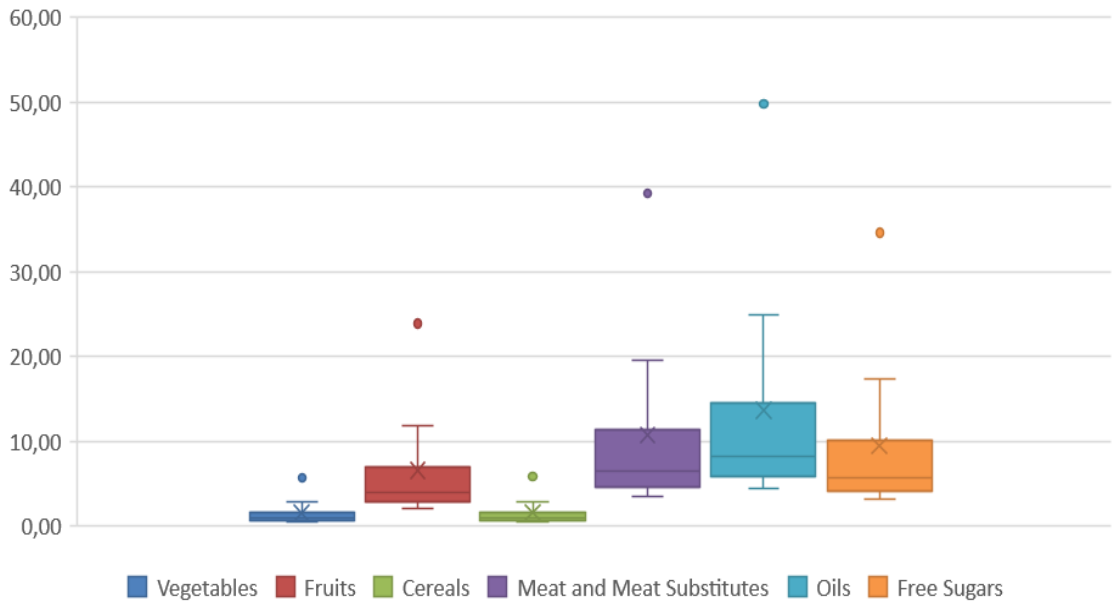

Figure B-21: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Trikala, Greece.***

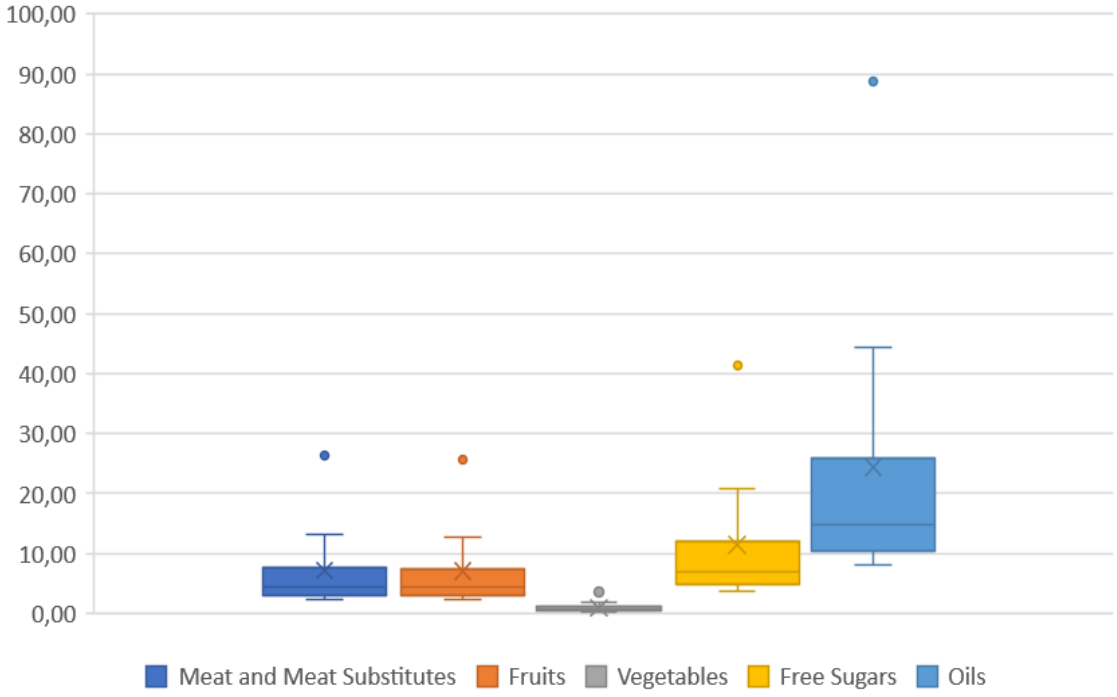

Figure B-22: *Box- plot representing the range of the daily coverage per food group for the* ***Social Partnership of Regional Unit of Chalkidiki, Greece.***