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Food security in Syria: Preliminary results based on the 2006/07 expenditure survey

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1 Introduction

Following a visit to Syria in August/September 2010, Olivier De Schutter, the UN Special Rapporteur on the right to food noted that Syria has managed to ensure a basic level of food security for most of its population, despite a relatively rapid 2.45% annual rate of population growth. De Schutter highlighted a number of issues such as climate change and the influx of refugees from Iraq that present a challenge to the maintenance of food security in the future. He also pointed out that the available information on poverty and food insecurity in Syria is tentative and that there is a need for improved mapping of these phenomena in the country (United Nations 2010).

In this paper we attempt to contribute to such an improved mapping by analyzing the nutritional status of a representative sample of households in Syria. According to the preliminary results of this analysis, average levels of nutrient intake are relatively high in Syria, indicating a rather high prevalence of food security, at least as far as access to dietary food energy and macronutrients is concerned. More research is needed to address a number of methodological issues (e.g. nutrient values, outliers, the difference between expenditure and consumption) and to reconcile our results with compilations from Syria's food balance sheets, which indicate a lower mean food intake, and with other sub-national survey results.

2 Data and methods

The following analysis has been carried out using data from a comprehensive household expenditure survey carried out by the Syrian Central Bureau of Statistics (CBS) in 2006/07. The CBS data covers a representative sample of 12,009 observations from all governorate centers and other urban areas as well as rural areas in Syria. For each household, the CBS data includes detailed monthly expenditure data (in monetary and quantity terms), including expenditure on a comprehensive set of food products.

To generate insights into the food security situation in Syria, we converted the information on food quantities into average daily intakes per person for each household for the following six dietary components/nutrients: calories (kcal); protein (g), fat (g), carbohydrates (g), calcium (mg) and iron (mg). To this end we employed detailed food composition tables provided by Dr. Abdulrahman O. Musaiger and Dr. Mohammed Mahmoud, Arab Center for Nutrition, Bahrain Center for Studies and Research. In the absence of a specific Syrian food composition table, the Center considers the composition data provided to us as the most adequate for Syria, as they relate to neighboring countries in the same region. The data

provided by the Bahrain Center were subsequently used to calculate the food energy contents of the various food items with standardized factors (4.0 kcal/g for protein, 9.0 kcal/g for fat and 4.0 kcal/g for carbohydrates). The complete composition table is presented in Annex Table 1 below. The result was an estimate for each household of total daily per person consumption of each of the six components listed above.

Before proceeding with the presentation and discussion of our results a number of caveats must be mentioned. First, the food composition values that we employed are not definitive. Our composition values are based on values compiled by experts for the Middle East region, but they may not apply to all foodstuffs as they are specifically produced, processed, prepared and consumed in Syria[1]. Second, for most of the food products included in the expenditure survey there will be a normal biological range of component values, so that food compositions values will at best apply on average. Finally, expenditure is not the same as consumption due to factors such as spoilage and losses in preparation, and possible consumption of subsistence production. Abstracting from subsistence production, expenditure data will provide an upper-bound estimate of consumption, *ceteris paribus*.

A further problem became apparent when we viewed our initial results and found evidence that the dataset contains a number of outliers, for example households with apparent daily consumptions of over 20,000 or under 300 kcal per person. Figure 1 presents the distribution of calorie consumption levels over all households in the sample. Figure 2 reproduces the same data as Figure 1 but with a rescaled y-axis that provides more resolution on the calorie consumption ranges with lower frequencies (between 0 and 100 observations in the dataset, as opposed to between 0 and 4,000 observations in Figure 1). Figure 2 reveals a number of implausibly high calorie consumption values in the dataset. Similar outliers were also identified for the other five components/nutrients considered in this analysis (see the distributions for these components/nutrients in Annex 2).

To deal with this problem, we first determined that the distributions of the log component expenditures are nearly symmetric (see Annex 2). We calculated the standard deviations of these distributions and eliminated from the dataset all households for which one or more of the component expenditure levels does not lie within three standard deviations of the mean. This reduced the size of the dataset by 433 observations from 12,009 to 11,566 households.

[1] It would have been interesting, but beyond the scope of this research project, to undertake a comparative evaluation of alternative food composition data, in particular the data set provided by Samir Jrad from the NAPC. Judging which of the two data sets is more realistic would require more information on the sources of the respective data and the specific definitions used, e.g. whether special adjustments have been applied to account for refuse or for the fibre part of total carbohydrate before calculating energy.

Converted back from logarithms into levels, the ranges of component expenditure values that were maintained in the dataset are presented in Table 1.

Figure 1: The distribution of calorie expenditures (kcal/person/day)

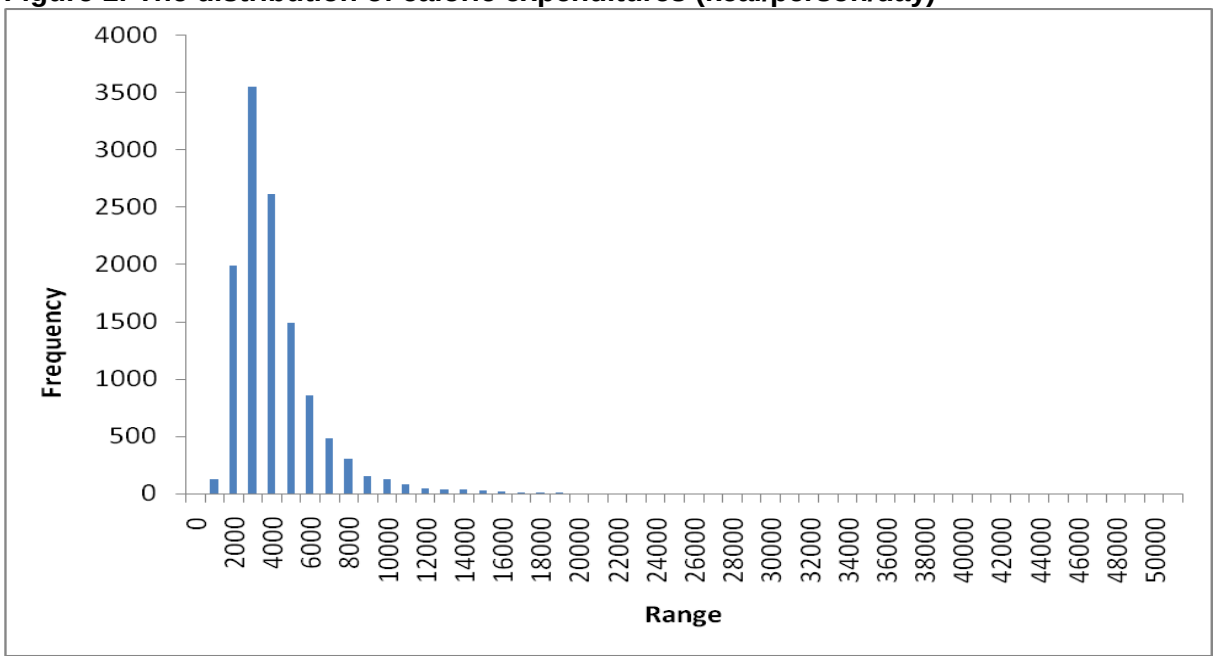

Figure 2: The distribution of calorie expenditure levels (kcal/person/day – see Figure 1) in the frequency range from 0 to 100

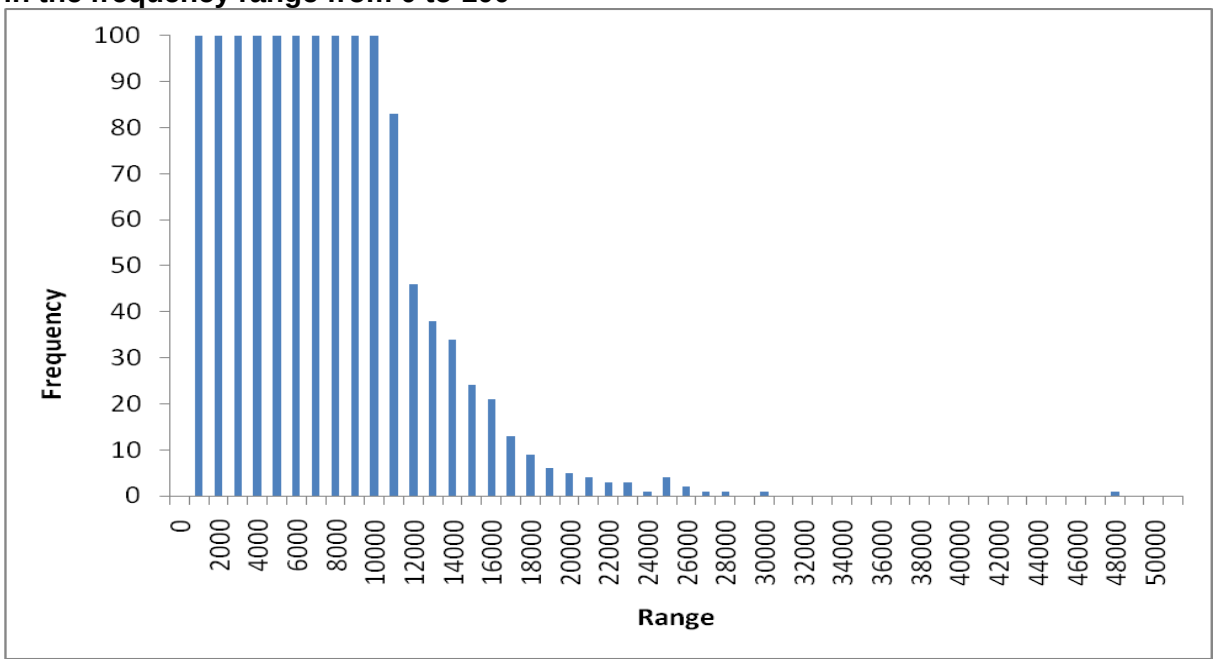

Table 1: Three-standard error bands for each food component based on the log distribution of daily nutrient intake per person

Limit	Calories (kcal)	Protein (g)	Fat (g)	Carbohy-drates (g)	Calcium (mg)	Iron (mg)
Lower limit	549.6	20.2	4.99	88.2	131.7	4.86
Upper limit	13,555.7	327.7	860.0	1627.7	3328.9	83.5

As can be seen in Table 1, even after removing values that lie outside the plus/minus three standard error range, a wide range of food component values remains. For example, per capita calorie expenditures of up to 13,555.7 kcal/day remain in the dataset. While even these values might be considered implausible, we were hesitant to apply even stricter criteria in eliminating outliers. We can only speculate as to the reasons for such values. Simple errors in recording expenditure are inevitable in such a large dataset. In some cases, the true number of individuals in a household or being fed by a household may be misrepresented; in others households may have purchased large amounts of a foodstuff for storage purposes. Random inspection of the data revealed anomalies such as one household that reported expenditure on olive oil of 24,4 liters per person and month, or 0.81 liters per person and day. We were unable to check for such anomalies on an observation-by-observation basis, but closer examination of the expenditure survey data will be required to increase its reliability for work on food security.

3 Food expenditure and shares of food expenditure by region and income

Table 2 summarizes descriptive statistics on the households in the corrected sample. The average household size is 5.8 persons, and average total food expenditure per household accounts for 10,678 Syrian Pound (SP) per month. Compared with the other categories, food accounts on average for the highest proportion (42%) of total household expenditure. However, the proportion of food in total expenditures varies considerably in the sample, from 3% to 97%.

Table 2: Descriptive statistics (all values in Syrian Pound except for household size)

	N	Min.	Max.	Mean	Std. dev
Sum of transferred (abroad) and generated income per month	11,566	0	3,344,300	25,372	47,479
Household size (no.)	11,566	1	23	5.75	2.5
Monthly expenditure on foodstuffs	11,566	304	85,532	10,678	6,531
Monthly expenditure on clothing	11,566	0	21,983	1,981	2,165
Monthly expenditure on housing	11,566	295	417,124	8,556	10,607
Monthly expenditure on transportation	11,566	0	48,175	1,617	1,973
Monthly expenditure on education and training	11,566	0	34,042	230	791
Monthly expenditure on medical	11,566	0	204,333	1,065	4,218
Other monthly expenditure	11,566	0	251,025	1,363	5,540
Total monthly expenditure	11,566	2,104	442,076	25,490	18,224

Table 3 shows how average monthly food expenditure varies across rural/urban areas. Households in the governorate centers spend on average less money on food products than households in urban and rural areas. Households in rural areas spend on average the highest amount of money on food products. Table 4 presents the proportion of the food expenditure in total expenditure in urban and rural areas. The proportion of total expenditure

used to buy foodstuffs is higher in rural areas (50%) than in other urban areas (45%) and in governorate centers (39%).

Table 3: Average monthly food expenditure in rural and urban households (in Syrian Pound)

Stratum	N	Mean*	Std. dev.	Min.	Max.
Governorate center	4,383	10,289.5 a	5,835.4	751.3	53,837.5
Other urban area	2,369	10,735.3 b	6,745.6	304.2	71,047.3
Rural area	4,814	11,002.5 b	6,989.7	669.2	85,531.7
Sample	11,566	10,677.6	6,756.4	304.2	85,531.7

* One-way ANOVA, F statistic = 13.819; p-value = 0.00.
[a b] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 4: The average share of food expenditure in total expenditure in rural and urban households (in %)

Stratum	N	Mean*	Std. dev.	Min.	Max.
Governorate center	4,383	0.39[a]	0.13	0.03	0.84
Other urban area	2,369	0.45[b]	0.14	0.03	0.93
Rural area	4,814	0.50[c]	0.15	0.03	0.97
Sample	11,566	0.44	0.15	0.03	0.97

* One-way ANOVA, F statistic = 663.17; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05) .

Analogous to Tables 3 and 4, Tables 5 and 6 present information on average monthly food expenditure in different income strata, and the average share of food expenditure in total expenditure in these strata, respectively. As expected, we observe that food expenditure increases with income, but at an underproportional rate. Hence, doubling income does not lead to a doubling of food expenditure, and the share of food in total expenditure correspondingly falls as income increases.

Table 7 cross-tabulates average monthly food expenditures by urban/rural region and income stratum, and Table 8 does the same thing for the average shares of food in total expenditure. These tables confirm that food expenditure increases with income at a decreasing rate in all types of rural and urban regions. Furthermore, they also confirm that absolute and proportional per household food expenditures are highest in rural areas.

Table 5: Average monthly food expenditure by income group (in Syrian Pound)

Monthly household income	N	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	7,282.0[a]	5,058.1	304.2	49,381.5
10,001-20,000	4,834	9,143.0[b]	5,144.1	836.5	67,512.8
20,001-30,000	3,042	11,391.4[c]	6,349.3	1,064.6	85,531.7
30,001-40,000	1,385	12,942.8[d]	6,513.7	1,566.5	50,065.8
More than 40,000	1,201	15,555.5[e]	8,875.0	1,186.3	71,099.0
Sample	11,566	10,677.6	6,531.0	304.2	85,531.7

* One-way ANOVA, F statistic = 410.482; p-value = 0.00.
[a b c d e] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 6: Average food expenditure/total expenditure ratio by income group

Monthly household income	N	Mean*	Std. dev.	Min.	Max.
700-10,000	1104	0.51[a]	0.15	0.04	0.93
10,001-20,000	4834	0.47[b]	0.14	0.03	0.91
20,001-30,000	3042	0.44[c]	0.14	0.04	0.87
30,001-40,000	1385	0.41[d]	0.14	0.03	0.97
More than 40,000	1201	0.37[e]	0.14	0.03	0.85
Sample	11566	0.45	0.15	0.03	0.97

* One-way ANOVA, F statistic = 211.550; p-value = 0.00.
[a b c d e] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 7: Per household monthly food expenditure by income category and region (in Syrian Pound, standard deviations in brackets)

Monthly household income	Region		
	Governorate center	Urban area	Rural area
700-10,000	5,558.23	7,234.1	7,781.8
	(3,146.0)	(4,730.4)	(5,479.6)
10,001-20,000	8,196.0	9,134.0	9,838.6
	(4,242.4)	(5,202.2)	(5,589.4)
20,001-30,000	10,320.6	11,757.2	12,340.6
	(4,901.0)	(6,626.7)	(7,332.6)
30,001-40,000	12,210.9	13,458.6	13,792.7
	(5,599.8)	(6,864.0)	(7,461.8)
More than 40,000	14,666.4	16,890.1	16,546.7
	(7,835.4)	(10,416.2)	(9,681.6)

Table 8: The average share of food expenditure in total expenditure ratio by income class and region (in %, standard deviations in brackets)

Monthly household income (SP)	Region		
	Governorate center	Urban area	Rural area
700-10,000	0.43	0.49	0.54
	(0.14)	(0.15)	(0.15)
10,001-20,000	0.42	0.46	0.51
	(0.12)	(0.13)	(0.14)
20,001-30,000	0.39	0.44	0.48
	(0.12)	(0.13)	(0.15)
30,001-40,000	0.37	0.42	0.46
	(0.12)	(0.14	(0.15)
More than 40,000	0.33	0.39	0.42
	(0.12)	(0.14)	(0.15)

This latter result is initially surprising because one might expect most food prices (with the possible exception of imported foods) to be lower in rural areas and food expenditures to be therefore lower as well, all other things being equal. However, the picture changes when we take different household sizes in rural and urban areas into account. Average food expenditure per person is actually highest in the governorate centers (5.11 individuals per household, per capita monthly food expenditure of 2,266 SP), followed by urban areas (5,78 individuals and 2,019 SP/person/month) and rural areas (6,31 individuals and 1,888 SP/person/month).

4 Nutrient intakes

Table 9 presents the average daily nutrient intakes per person calculated using the method described above. Table 9 shows that mean nutrient intake levels are similar to other sources. We find a value for daily food energy of 3,002 kcal/person compared with the FAO's Food Balance Sheet estimate for 2005/2007 of 3,050 kcal/person (FAO 2010a).

Table 9: Average daily nutrient intake per person (based on 11,566 households)

Nutrient	Mean	Std. dev.	Min.	Max.	Recommended intake*	Households under recommended intake (%)***
Calories (kcal)	3,002.3	1,595.8	549.6	13,555.7	2,700**	53.4
Proteins (g)	91.2	41.7	20.2	327.7	41.4-75	3.9
Fat (g)	96.1	96.7	5.0	860.0	41.4-75	28.3
Carbohydrate(g)	445.1	221.8	88.2	1,627.7	up to 360	-
Calcium (mg)	769.2	428.0	131.7	3,328.9	840-999	67.9
Iron (mg)	23.9	11.4	4.9	83.5	12-18	7.6

* Source: conversation with Samir Jrad, NAPC, Damascus. ** Estimated average considering from full rest to hard work. *** Percentage of households which get less or more than the recommended nutrient intake.

Table 9 also lists a set of recommended daily nutrient intakes provided by the NAPC (second-to-last column) and the share of households that consume less than these recommended intakes (last column). The recommended intakes in Table 9 are not to be confused with the minimum dietary requirements used by FAO to estimate undernourishment. FAO defines people as undernourished when their daily food energy intake does not meet the minimum dietary requirement (FAO 2010b und 2010c). In the FAO's calculation, the minimum requirement is derived from the minimum energy needs of different age-sex groups, assuming *inter alia* only light physical activity of adults, and the intra-national inequality of food intake is derived from a special distribution function[2] (FAO 2010b.). Accordingly, the recommended intakes listed in Table 9 are higher than the FAO minimum dietary requirements. For example, the recommended intake listed in Table 9 is 2,700 kcal/ person/day, while the FAO used a minimum dietary requirement of 1,800 kcal/person/day in its analysis of undernourishment in Syria in 2004/06 (FAO 2010b). Hence, the prevalence of households with consumption levels below the recommended intakes in Table 9 is much higher than the prevalence of undernourishment. According to the FAO's 2005/07 analysis, the prevalence of undernourishment in Syria is less than 5% (FAO 2010c), while Table 9 indicates that 53.4% of the population consumes less than the recommended intake of 2,700 kcal/person/day. When we apply the minimum dietary requirement of 1,800

[2] In line with detailed norms established by nutrition experts, FAO compiles the prevalence of undernourishment in terms of the estimated share of persons in a population whose daily consumption does not meet the minimum dietary food energy requirements. The minimum requirements of children account for child growth, and the minimum requirements of adults is defined as the sum of the basal metabolic rate and an amount needed for light activity, plus an additional amount for pregnancy. The mean requirements of the population are calculated as weighted average over all age-sex groups.

kcal/person/day to our household data, we find that 20.9% of the population is undernourished.[3, 4]

4.1 Nutrient intakes by income group

4.1.1 Calories

Table 10 reveals that calorie intake does not differ significantly across the income groups ranging from 10,001 to 40,000 SP/month. Individuals in the lowest income stratum consume on average more calories per day than those in other categories, and those in the highest income stratum consume the second most calories, leading to a U-shaped relationship between income and calorie intake.

Table 10: Average daily calorie intake per person by income group (kcal/person/day)

Household income (SP)	N (households)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	3,382.3[c]	1,876.0	549.6	11,953.1
10,001-20,000	4,834	2,931,1[a]	1,529.3	562.9	13,555.7
20,001-30,000	3,042	2,938.1[ab]	1,540.4	662.0	11,788.2
30,001-40,000	1,385	3,017.4[ab]	1,602.1	594.7	12,771.7
More than 40,000	1,201	3,084.7[b]	1657.1	641.5	11,328.9
Sample	11,566	3,002.3	1,595.8	549.6	13,555.7

* One-way ANOVA, F statistic =20.246; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.1.2 Protein

Table 11 reveals a similar U-shaped relationship between protein consumption and income, with the lowest and highest income strata displaying the highest per person intakes, and the middle strata between 10,000 and 30,000 SP displaying lower levels.

Table 11: Average daily protein intake per person by income group (g/person/day)

Household income (SP)	N (households)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	97.2[a]	48.1	21.4	327.7
10,001-20,000	4,834	87.7[c]	39.4	20.9	321.0
20,001-30,000	3,042	90.8[bc]	41.3	20.2	325.6
30,001-40,000	1,385	94.3[ab]	42.1	20.9	322.4
More than 40,000	1,201	97.1[a]	43.7	26.2	327.4
Sample	11,566	91.2	41.7	20.2	327.71

* One-way ANOVA, F statistic = 22.085; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

[3] The reasons for the discrepancy between the FAO's estimate of undernourishment and our's can only be revealed by further research. Unlike our estimates, which are based on a household survey, FAO estimates are based on national food balance sheets. However, FAO assumes a coefficient of variation of 0.27 for the log consumption distribution, while in our sample the coefficient of variation is 0.55. This coefficient depends on the assumptions made about what constitutes an outlier. In addition, it is known that FAO's assumptions about the coefficient of variation are not based on recent data.
[4] Overnutrition is also a serious problem that coexists with undernutrition in many countries worldwide. The distributions that we have calculated indicate that many Syrian households consume much more than the recommended levels of calories, proteins and fats. While this is not directly relevant for the question of national food security in Syria, it does deserve attention in future research.

4.1.3 Fats

The U-shaped relationship between intake and income is also found for fats (Table 12), with the highest and lowest income strata consuming more than the middle strata, and the those with incomes between 10,000 and 30,000 SP consuming the least.

Table 12: Average daily fat intake per person by income group (g/person/day)

Household income (SP)	N (households)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	108.1[a]	112.8	6.4	850.8
10,001-20,000	4,834	88.5[c]	89.9	5.0	860.0
20,001-30,000	3,042	96.2[bc]	97.1	5.2	856.7
30,001-40,000	1,385	101.1[ab]	96.2	6.1	822.4
More than 40,000	1,201	109.2[a]	103.3	7.5	847.8
Sample	11,566	96.1	96.7	5.0	860.0

* One-way ANOVA, F statistic = 18.256; p-value = 0.00.
[a b c d] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.1.4 Carbohydrates

For carbohydrates, Table 13 reveals a departure from the U-shaped relationship between income and intake presented above for calories, protein and fat. The highest level of carbohydrate intake is found in the lowest income stratum, and carbohydrate intake is significantly lower in all of the higher income strata.

Table 13: Average carbohydrates intake per person by income group (g/person/day)

Household income (SP)	N (households)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	506.7[b]	255.6	91.1	1,601.8
10,001-20,000	4,834	447.2[a]	220.4	90.3	1,620.5
20,001-30,000	3,042	429.4[a]	209.3	89.8	1,571.2
30,001-40,000	1,385	435.2[a]	215.7	88.2	1,596.8
More than 40,000	1,201	431.0[a]	222.0	91.1	1,627.7
Sample	11,566	445.1	221.8	88.2	1,627.7

* One-way ANOVA, F statistic = 27.372; p-value = 0.00.
[a b] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.1.5 Calcium and iron

The U-shaped relationship between income and intake is apparent once more for calcium and iron in Tables 14 and 15, respectively, with high intake levels in the lowest and highest income strata and lower levels in the strata in between.

Table 14: Average daily calcium intake per person by income group (mg/person/day)

Household income (SP)	N (household)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	807.6[bc]	462.8	135.5	3,022.8
10,001-20,000	4,834	725.3[a]	397.1	131.7	3,328.9
20,001-30,000	3,042	772.6[b]	428.6	141.9	3,312.8
30,001-40,000	1,385	816.8[c]	455.3	135.7	3,239.3
More than 40,000	1,201	846.6[c]	459.0	134.7	3,111.5
Sample	11,566	769.2	428.0	131.7	3,328.9

* One-way ANOVA, F statistic = 29.402; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 15: Average daily iron intake per person by income group (mg/person/day)

Household income (SP)	N (household)	Mean*	Std. dev.	Min.	Max.
700-10,000	1,104	25.3[c]	12.4	6.1	82.9
10,001-20,000	4,834	23.2[a]	10.9	5.3	82.7
20,001-30,000	3,042	23.8[ab]	11.4	4.9	82.2
30,001-40,000	1,385	24.4[bc]	11.3	5.0	83.5
More than 40,000	1,201	25.0[c]	11.9	5.0	80.9
Sample	11,566	23.9	11.4	4.9	83.5

* One-way ANOVA, F statistic = 12.221; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.2 Nutrient intakes in rural and urban regions

4.2.1 Calories

Table 16 reveals significant differences in calorie intake between regions. People in rural areas consume the most calories per day, while those living in other urban areas and then governorate centers consume progressively less.

Table 16: **Average daily calories intake per person by region (kcal/person/day)**

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	2,744.3[a]	1,381.8	641.5	13,555.7
Other urban areas	2,369	2,836.3[b]	1,488.1	562.9	11,788.2
Rural areas	4,814	3,318.9[c]	1,765.5	549.6	13,068.3
Sample	11,566	3,002.3	1,595.8	549.6	13,555.7

* One-way ANOVA, F statistic = 169.633; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.2.2 Protein

Table 17 shows that there are also significant differences in protein intake between regions. The highest levels of intake are attained in rural areas, while protein intake in governorate centers and then other urban areas is significantly lower.

Table 17: Average daily protein intake per person by region (g/person/day)

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	90.5[b]	42.2	22.6	325.6
Other urban areas	2,369	86.8[a]	39.6	20.2	324.8
Rural areas	4,814	94.1[c]	42.1	20.9	327.7
Sample	11,566	91.2	41.7	20.2	327.7

* One-way ANOVA, F statistic = 25.390; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.2.3 Fats

Table 18 shows that the pattern of fats intake across regions is similar to that of calories and protein in that people living in rural areas display the highest intakes. However, there is no significant difference between the lower levels observed in other urban areas and governorate centers.

Table 18: Average daily fat intake per person by region (g/person/day)

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	87.8[a]	82.6	5.3	850.8
Other urban areas	2,369	92.0[a]	95.4	5.0	860.0
Rural areas	4,814	105.6[b]	107.7	5.2	856.7
Sample	11,566	96.1	96.7	5.0	860.0

* One-way ANOVA, F statistic = 41.808; p-value = 0.00.
[a b] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.2.4 Carbohydrates

Table 19 reveals significantly increasing levels of carbohydrate intake as one moves from governorate centers to other urban and rural areas, as is also the case for calories (see Table 16).

Table 19: Average daily carbohydrate intake per person by region (g/person/day)

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	400.4[a]	189.6	88.2	1,627.7
Other urban areas	2,369	416.4[b]	199.1	89.8	1,602.7
Rural areas	4,814	499.9[c]	246.5	91.1	1,607.6
Sample	11,566	445.1	221.8	88.2	1,627.7

* One-way ANOVA, F statistic = 267.318; p-value = 0.00.
[a b c] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.2.5 Calcium and iron

Calcium intakes are significantly higher in governorate centers than in rural areas, with urban areas falling in between (Table 20). For iron (Table 21) intakes are highest in rural areas, followed by governorate centers and urban areas, with all differences being statistically significant.

Table 20: Average daily calcium intake per person by region (mg/person/day)

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	782.4[b]	429.4	149.1	3,245.5
Other urban areas	2,369	767.1[ab]	436.7	131.7	3,273.1
Rural areas	4,814	758.1[a]	422.1	132.4	3,328.9
Sample	11,566	769.2	428.0	131.7	3,328.9

* One-way ANOVA, F statistic = 3.726; p-value = 0.024.
[a b] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 21: Average daily iron intake per person by region (mg/person/day)

Region	N (households)	Mean*	Std. dev.	Min.	Max.
Governorate centers	4,383	23.7[b]	11.7	5.0	83.5
Other urban areas	2,369	22.5[a]	10.5	4.9	82.2
Rural areas	4,814	24.7[c]	11.4	5.0	82.9
Sample	11,566	23.9	11.4	4.9	83.5

* One-way ANOVA, F statistic = 31.463; p-value = 0.00.
[a b] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.3 Nutrient intakes in governorates

4.3.1 Calories

The information on average per person calorie intakes (Table 22) reveals significant differences between governorates in Syria. The lowest monthly calorie intakes are recorded in Damascus and Idleb, and the highest intakes are recorded in Al-Raqqa, Quneitra and Dar'a. Average calorie intake in the governorate Quneitra is 72% higher than in Idleb.

Table 22: Average daily calorie intake per person by governorates (kcal/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	2,673.1[ab]	1,315.3	641.5	9,954.2
Aleppo	2,569	2,814.2[abc]	1,365.6	650.1	11,400.5
Damascus	1,575	2,650.8[ab]	1,385.1	562.9	11,462.1
Homs	1,043	3,087.3[cd]	1,893.3	702.8	13,068.3
Hama	863	3,620.5[e]	1.740.6	836.9	11,267.5
Lattakia	670	2,951.2[bcd]	1,324.3	616.9	10,467.1
Idleb	620	2,488.3[a]	1,408.5	589.9.	11,788.2
Al-Hassake	683	3,276.2[de]	1,463.8	815.5	10,615.8
Dair-Ezzor	525	2,921.7[bcd]	1,472.4	788.7	9,876.4
Tartous	516	3,069.5[cd]	1,634.5	589.0	10,994.3
Al-Raqqa	404	4,133.7[f]	1,764.5	1082.5	13,555.7
Dar'a	445	4,052.7[f]	2,268.8	907.6	11,953.1
Sweida	224	3,192.5[cd]	1,790.2	549.6	11,960.4
Quneitra	57	4,280.3[f]	1,852.6	1181.4	8,618.1
Sample	11,566	3,002.3	1,595.8	549.6	13.555.7

* One-way ANOVA, F statistic = 68.342; p-value = 0.000.
[a b c d e f g] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.3.2 Protein

Table 23 shows that people living in the governorates Idleb, Aleppo and Damascus consume on average the lowest amounts of protein per day. The highest daily protein consumption is reached in Lattakia, Hama, and Dar'a. As with calories, the differences are significant and large, with average protein consumption in Dar'a exceeding that in Aleppo by 38%.

Table 23: Average daily protein intake per person by governorates (g/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	89.4[bcd]	46.5	22.6	325.6
Aleppo	2,569	81.1[abc]	34.8	22.1	302.7
Damascus	1,575	83.8[ab]	38.5	20.2	306.9
Homs	1,043	93.1[cde]	41.8	25.7	320.1
Hama	863	110.4[g]	44.3	31.7	304.2
Lattakia	670	104.8[fg]	40.6	24.3	327.4
Idleb	620	76.3[a]	35.1	20.9	279.0
Al-Hassake	683	99.5[def]	41.5	21.5	322.4
Dair-Ezzor	525	89.9[bcd]	42.5	22.8	327.7
Tartous	516	102.8[egf]	44.1.	25.4	267.1
Al-Raqqa	404	89.7[bcd]	32.0	24.2	219.1
Dar'a	445	112.0[g]	46.7	32.4	297.1
Sweida	224	97.3[def]	45.7	21.4	286.6
Quneitra	57	103.2[gf]	42.7	31.9	271.6
Sample	11,566	91.2	41.7	20.2	327.7

* One-way ANOVA, F statistic = 59.487; p-value = 0.000.
[a b c d e f g] Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.3.3 Fats

The general pattern of lower intake levels in Damascus city and in the governorate Idleb compared with, in particular, Dar'a and Quneitra is confirmed in Table 24 for fats.

Table 24: Average daily fat intake per person by governorates (g/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	79.9^{ab}	78.4	5.3	860.0
Aleppo	2,569	85.1^{abcd}	83.0	5.9	855.8
Damascus	1,575	82.4^{abc}	87.5	5.0	856.7
Homs	1,043	108.6^{ef}	118.5	9.3	840.6
Hama	863	136.5^{gh}	118.9	6.7	764.1
Lattakia	670	91.7^{abcde}	81.9	12.2	849.3
Idleb	620	77.7^{a}	95.5	5.2	847.8
Al-Hassake	683	104.1^{cdef}	70.4	7.3	523.5
Dair-Ezzor	525	86.5^{abcd}	75.7	6.1	523.1
Tartous	516	101.0^{bcdef}	114.3	5.5	843.6
Al-Raqqa	404	118.7^{fg}	97.9	8.2	778.9
Dar'a	445	143.0^{h}	138.3	9.0	757.0
Sweida	224	105.4^{def}	102.6	8.9	717.5
Quneitra	57	149.6^{h}	129.2	12.0	447.6
Sample	11,566	96.1	96.7	5.0	860.0

* One-way ANOVA, F statistic = 36.201; p-value = 0.000.
$^{a\,b\,c\,d\,e\,f\,g\,h}$ Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.3.4 Carbohydrates

For carbohydrates (Table 25), daily carbohydrate intake is lowest in the governorates Damascus and Idleb, while Al-Raqqa and Quneitra display the highest levels.

Table 25: Average daily carbohydrate intake per person by governorates (g/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	400.7^{abc}	189.5	91.1	1,461.5
Aleppo	2,569	432.4^{bcd}	204.1	88.2	1,596.8
Damascus	1,575	394.5^{ab}	183.7	89.8	1,602.7
Homs	1,043	435.5^{bcd}	224.3	90.3	1,506.9
Hama	863	494.4^{f}	197.4	124.5	1,537.5
Lattakia	670	430.4^{bcd}	180.7	95.1	1,332.9
Idleb	620	373.0^{a}	191.3	91.1	1,586.2
Al-Hassake	683	485.2^{ef}	245.8	106.1	1,627.7
Dair-Ezzor	525	446.2^{cde}	213.6	104.0	1,561.9
Tartous	516	442.8^{bcde}	202.2	98.3	1,594.6
Al-Raqqa	404	676.4^{i}	310.6	107.4	1,620.5
Dar'a	445	580.6^{g}	298.0	133.0	1,572.5
Sweida	224	463.8^{def}	260.7	95.6	1,485.3
Quneitra	57	630.3^{h}	262.3	195.6	1,203.4
Sample	11,566	445.1	221.8	88.2	1,627.7

* One-way ANOVA, F statistic = 77.486 p-value = 0.000.
$^{a\,b\,c\,d\,e\,f\,g}$ Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

4.3.5 Calcium and iron

Table 26 reveals that the governorate Al-Raqqa, which with the exception of protein tends to rank relatively high for other nutrient intakes, has the lowest observed level of per capita calcium intake. The governorates Aleppo and Idleb again rank low, while individuals living in Hama and Dar'a also display the highest daily calcium intakes. With some deviations (for example, Al-Raqqa ranks higher), the general pattern for iron intake is the same (Table 27), with Idleb, Aleppo and Damascus displaying relatively low levels, and the governorates Dar'a and Hama (as well as Tartous) the highest levels.

Table 26: Average daily calcium intake per person by cities (mg/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	769.2^{cd}	425.0	152.2	3,056.4
Aleppo	2,569	644.4^{ab}	394.3	132.4	3,245.5
Damascus	1,575	714.4^{bc}	365.1	132.4	2,920.9
Homs	1,043	768.1^{cd}	412.7	196.1	2,807.9
Hama	863	999.2^{g}	515.5	202.4	3,265.8
Lattakia	670	941.8^{fg}	380.9	212.1	2,951.9
Idleb	620	683.4^{bc}	337.0	189.4	2,362.2
Al-Hassake	683	885.8^{ef}	490.4	159.9	3,328.9
Dair-Ezzor	525	756.9^{cd}	440.5	132.7	3,190.2
Tartous	516	826.7^{de}	419.1	151.3	3,312.8
Al-Raqqa	404	563.7^{a}	275.4	174.0	2,441.7
Dar'a	445	1,013.3^{g}	446.6	188.9	2,970.5
Sweida	224	837.6^{de}	388.5	235.9	2,291.0
Quneitra	57	819.0^{de}	371.7	226.6	2,046.3
Sample	11,566	769.2	428.0	131.7	3,328.9

* One-way ANOVA, F statistic = 77.979; p-value = 0.000.
$^{a\ b\ c\ d\ e\ f\ g\ h\ i}$ Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

Table 27: Average daily iron intake per person by cities (mg/person/day)

City	N (households)	Mean*	Std. dev.	Min.	Max.
Damascus City	1,372	23.8^{bc}	12.6	5.9	83.3
Aleppo	2,569	21.3^{ab}	9.4	5.0	80.2
Damascus	1,575	21.1^{a}	9.8	4.9	75.1
Homs	1,043	23.7^{bc}	10.6	6.9.	82.0
Hama	863	30.7^{d}	13.6	8.4	82.9
Lattakia	670	28.9^{d}	12.1	6.1	82.7
Idleb	620	20.9^{a}	10.5	5.9	80.9
Al-Hassake	683	24.6^{c}	10.3	6.2	83.5
Dair-Ezzor	525	23.7^{bc}	10.7	5.0	76.3
Tartous	516	25.9^{c}	11.6	5.5	76.3
Al-Raqqa	404	25.6^{c}	9.1	6.4	78.3
Dar'a	445	29.1^{d}	13.4	6.4	75.1
Sweida	224	22.0^{ab}	10.4	6.5	72.6
Quneitra	57	21.7^{ab}	8.2	6.1	52.9
Sample	11,566	23.9	11.4	4.9	83.5

* One-way ANOVA, F statistic = 69.332; p-value = 0.000.
$^{a\ b\ c\ d}$ Indicate significant difference between mean values. Post-hoc test for mean contrast: Tukey-HSD (p-value < 0.05).

5 Conclusions

According to the results of this preliminary analysis, average levels of nutrient intake are relatively high in Syria. However, there is considerable variation in intake levels among the surveyed households. Slightly over 20% of these households report daily average calorie intakes that are below the FAO's minimum daily requirement of 1800 kcal (FAO 2010b). This suggests that undernutrition is a more widespread problem than indicated by previous estimates (e.g. the FAO estimate of under 5% undernutrition (FAO 2010c)). More research is needed to reconcile our results with those of the FAO and other sub-national survey results.

The highest levels of intake for most nutrients are found in the lowest and highest income strata (U-shaped relationship between income and intake). Generally, rural areas have higher levels of intake than governorate centers and urban areas, except for calcium and iron and to some extent protein. Rural areas therefore seem to be characterized by relatively carbohydrate- and fat-rich diets. At the city level, for most nutrients Damascus and Aleppo tend to rank among the cities with the lowest levels of per person intake, while Dar'a and Hama are consistently among the cities with the highest levels.

To conclude, this analysis is preliminary. The following issues require closer study:

- The definition, identification, explanation and treatment of outliers in the dataset.
- The food composition values used to convert food quantities into nutrients.
- The fact that our analysis is based on an expenditure survey. This will presumably lead to a overestimation of nutrient consumption (due to factors such as spoilage and food preparation losses).
- The treatment of subsistence production in the expenditure survey. If subsistence production is not accounted for, consumption in rural areas will be underestimated.
- The possible availability of panel data (i.e. observations of the same households at different points in time), which would make it possible to generate richer insights into the determinants of food insecurity.

References

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Annex 1: Food composition table used for the analysis

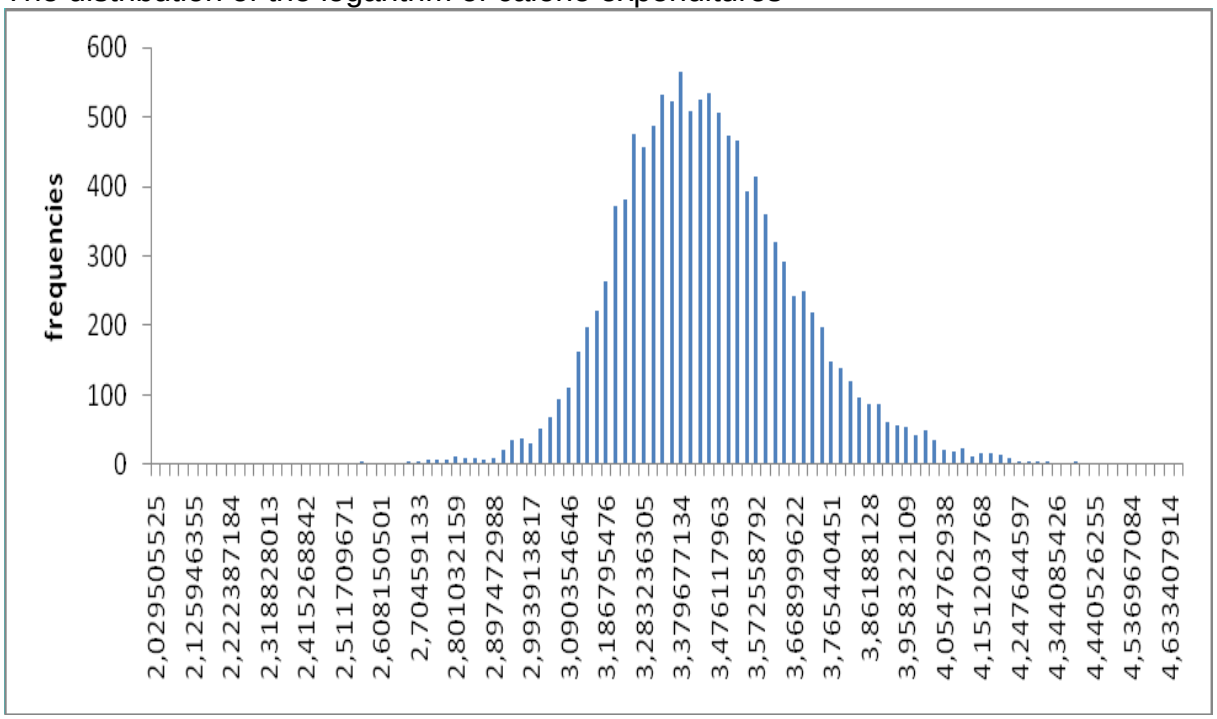
Item in 1000 g	Calories kcal	Proteins g	Fats g	Carbohydtates g	Calcium mg	Iron mg
Bread	2356	82	12	480	360	24
Wheat	3430	115	22	693	360	31.0
Flour	3542	100	10	763	180	8.5
Crushed wheat (bulgur)	3427	125	15	698	400	35.0
Non Subsidized rice	3507	73	7	788	300	6.9
Freeke (crushed wheat)	3513	116	17	724	410	30.0
Pasta, spaghetti	3611	120	11	758	350	14.0
Noodles	2184	51	60	360	180	6.0
Cakes	3788	70	184	463	580	5.0
Maize	1087	39	11	208	80	8.0
Subsidized rice	3507	73	7	788	300	6.9
Fine Grit	3309	96	5	720	700	10.0
Starch	3797	2	1	945	0	0.0
Lentils	3395	224	11	600	480	73.0
Crushed lentil	3399	229	7	605	500	68.0
Dry beans	1322	61	50	157	440	27.0
Chickpeas	3522	203	42	583	1270	67.0
Haricot beans	3117	221	17	520	1500	100.0
Sheep meat	2984	143	268	0	80	16.0
Goat meat	1564	184	92	0	110	22.0
Bovine meat (beef)	2932	184	244	0	130	28.0
Camel meat	1006	193	26	0	220	85.0
Caned red meat	2260	250	140	0	71	40.0
Poultry meat	2136	174	160	0	110	16.0
Turkey	1506	210	74	0	150	9.9
Canned Poultry meat	1592	218	80	0	60	30
Fresh fish	1079	195	33	0	224	14
Frozen fish	1079	195	33	0	224	14
Canned fish	1507	253	55	0	427	14
Egg	1575	128	115	7	540	27.0
Fresh milk	641	33	37	44	1230	0.5
Powder milk	4974	267	262	387	9300	0.4
Kids powder milk	4575	263	267	280	9,000	6
Canned pasteurized milk	4967	35	3	1200	1200	0.5
Yogurt	644	34	32	55	1680	2.0
Condensed yogurt	1969	103	121	117	3,075	3
Other kind of yougurt	593	35	33	39	1,230	1
White cheese	2562	163	198	32	4560	2.0
Caciocavallo	4263	274	343	20	11,000	7
Cottage cheese	999	130	35	41	3000	4.1
Foreign cheese	2880	187	228	20	6,800	10
Kinds of cheese	3838	233	311	27	6,800	10
Butter	7501	10	829	0	190	2.0
Baladi Ghee	8963	2	995	0	0	0.0
Cow ghee	8982	0	998	0	0	2.0
Kinds of ghee	8933	3	991	1	200	2
Olive oil	8999	0	1000	0	0	0.0
Cotton oil	8991	0	999	0	0	0.0
Corn oil (Mazola)	8991	0	999	0	0	0.0
Other oils	8999	0	1000	0	0	0.0
Margarine	7330	6	810	4	40	3.0
Fresh tomato	195	11	3	31	150	5.0
Potato	729	16	1	164	70	6.0
Haricot beans	298	18	2	52	350	17.5
Okra	470	20	2	93	980	19.0
Green kidney	3330	221	14	580	1480	72.0
Squash	238	13	2	42	250	5.0
Egg plant	282	17	2	49	150	5.0
Broad beans	3259	241	15	540	850	58.0

Cabbages	270	13	2	50	400	5.8
Cauliflower	283	23	3	41	300	5.0
Green peas	3449	221	21	594	820	58.0
Dry onion	598	12	2	133	350	5.0
Green pepper	243	13	3	41	150	9.0
Cucumbers	161	7	1	31	180	6.0
Carrot	362	12	2	74	400	5.8
Spinach	223	25	3	24	920	42.0
Mlokia	542	50	10	63	2700	42.0
Sugar beet	873	15	1	201	0	0.0
Kale	274	12	2	52	360	5.0
Garlic	1415	56	3	291	340	16.0
Green onion	490	11	2	107	1250	10.5
Radish	185	12	1	32	270	9.9
lettuce	155	11	3	21	280	10.0
Green mint	427	38	7	53	2100	95.0
Parsley	496	33	4	82	2100	65.5
Green coriander	222	24	6	18	980	19.0
Pumpkins	257	10	1	52	250	7.0
Leaf beet	284	16	4	46	1000	25.0
Dried vegetables	1408	76	16	240	1,316	58
Canned vegetable	322	14	3	60	203	11
Tomato paste	589	28	1	117	440	106.0
All kinds of oranges	555	11	3	121	370	3
Yousfi	478	7	2	108	390	5
Clementine	530	8	2	120	300	1.4
Lemon	318	8	2	67	320	5.0
Grapefruit	418	6	2	94	180	5
Pomegranate	684	7	4	155	150	3
Grapes	735	6	7	162	150	9
Figs	500	13	16	76	800	10
Apricots	580	9	4	127	150	5
Plums	498	7	2	113	190	6
Peaches	514	7	2	117	150	8
Pears	578	3	2	137	100	4
cherries	660	18	4	138	300	4
Banana	947	13	3	217	100	6
Apples	574	4	2	135	50	3
Water melon	261	4	1	59	60	4
Musk Melon	302	8	2	63	100	4
Krmesi	341	2	1	81	80	6
Date (palm)	3062	22	6	730	720	21
Canned fruits	608	4	0	148	50	3.0
Dried fruits	2852	23	4	681	730	22.0
Pistachio	6309	209	541	151	1220	69.0
Groundnut	5849	264	449	188	550	25.0
Dry almond	6398	176	558	168	2150	45.0
Walnut	6949	147	649	130	750	20.0
Cashew	5961	212	469	223	500	50.0
Non-subsidized sugar	3980	0	0	995	0	0.0
Subsidized sugar	3980	0	0	995	0	0.0
Molasses	2800	0	0	700	290	57.1
Honey	3148	3	0	784	150	8.0
Halvah	5212	105	280	568	350	30.0
Prepared marmalade	2784	1	0	695	350	6.0
Chocolate	5408	47	292	648	380	24.0
Candies	3920	0	0	980	-	-
Lokum	3717	3	2	923	780	62
Kind of candy	5983	100	261	808	1,436	25
Mabromeh (confectionery)	7252	100	402	808	71	2
Baklawa	4502	48	230	560	-	-
Qatayef	3476	50	128	531	-	-
Aoumeh and mchbek	3529	74	17	770	71	2
Knafeh with cheese	3605	30	145	545	-	-
Grebeh	5330	55	310	580	-	-

Ajoeh	3149	23	5	753	620	32.0
Ma'amoul with pistachio	4999	60	243	643	760	-
Other Arabic confectionary	3529	74	17	770	71	2
Piece of cake	3529	74	17	770	71	2
Medium size cake	3788	70	184	463	580	5.0
Biscuit	4378	96	118	733	1090	20.0
Olive	876	10	80	29	1050	14.0
Various kinds of pickled	164	11	0	30	1500	9.0
sesame	6002	190	518	145	8870	102.0
Tehina	6697	247	589	102	610	72.0
Thyme	949	30	25	151	6300	0.0
Salt	0	0	0	0	290	0.0
Roasted chicken	2010	291	94	0	160	21.0
Tea	0	0	0	0	0	0.0
Coffee	2942	104	154	285	1300	41.0
Mete	472	100	0	18	20	0
Cacao	5408	47	292	648	380	24.0
Soda water	420	0	0	105	40	0.0
Mineral water	0	0	0	0	0	0.0
Fresh fruit juice	558	5	1	132	124	1
Concentrated juice	1116	10	2	264	248	3
Powder juice	3920	11	0	969	-	-
Purchased Water	0	0	0	0	0	0.0
Wine	640	0	0	160	100	20
Local Arrack	0	0	0	0	0	0
Local beverages	0	0	0	0	0	0
Imported beverages	224	1	0	55	55	0
Ice cream	2090	35	111	238	600	1

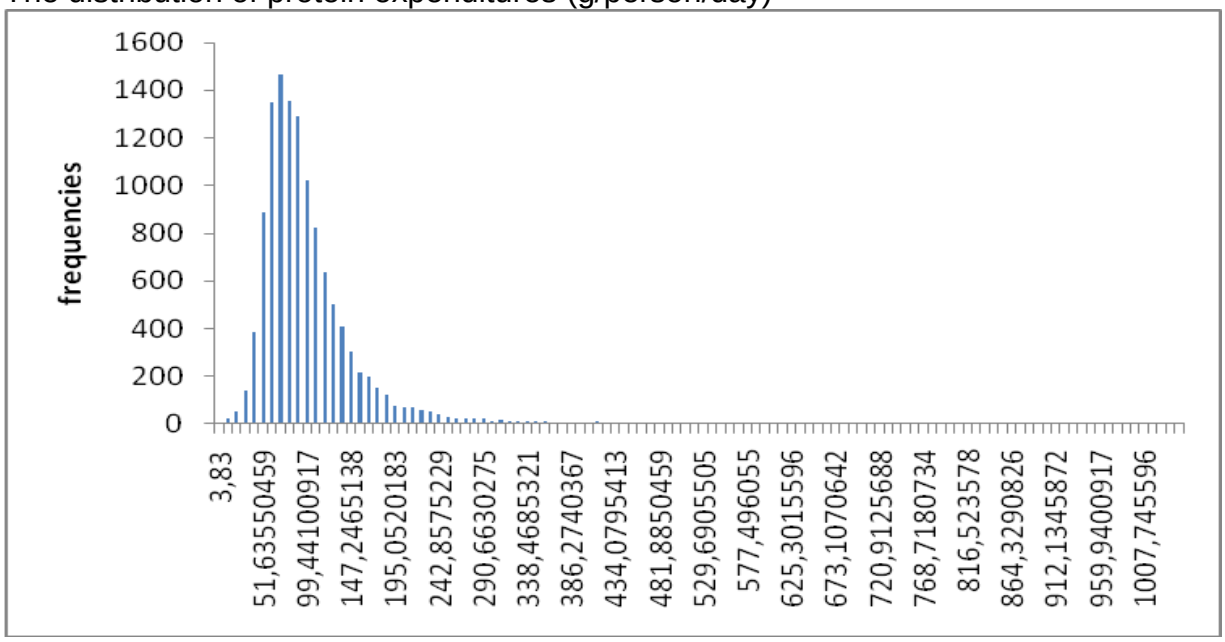
Annex 2: Distributions of nutrient/component expenditures

The distribution of the logarithm of calorie expenditures

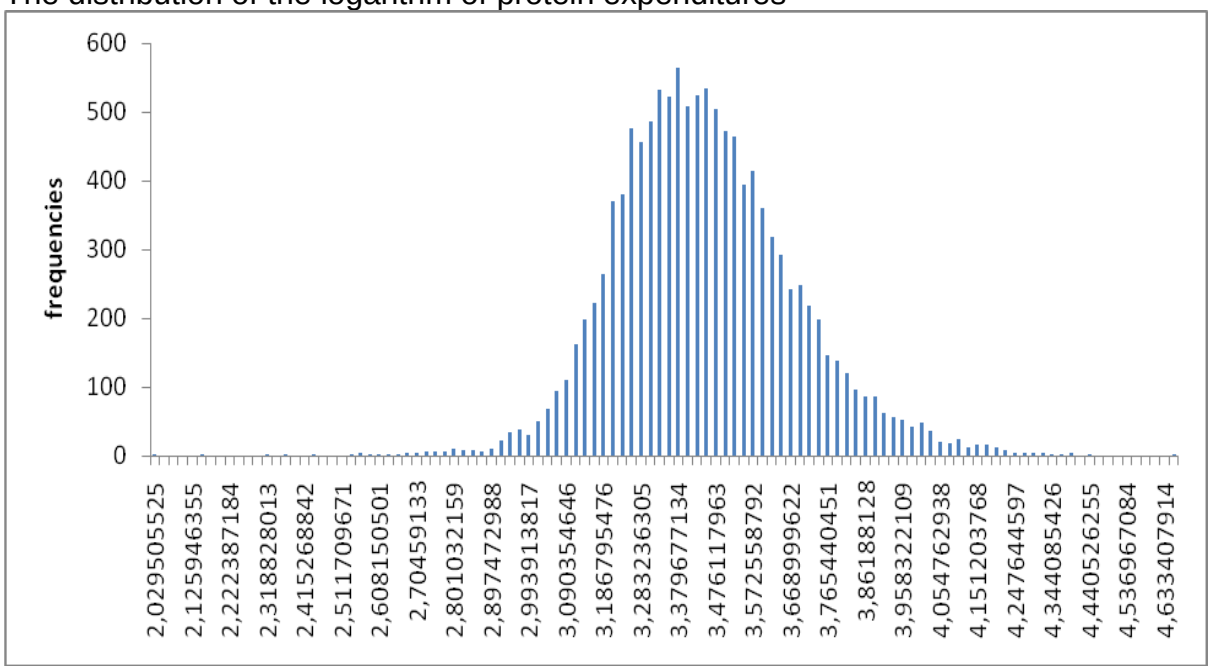


Note: The distribution of calorie expenditures is presented in Figure 1 in the text above.

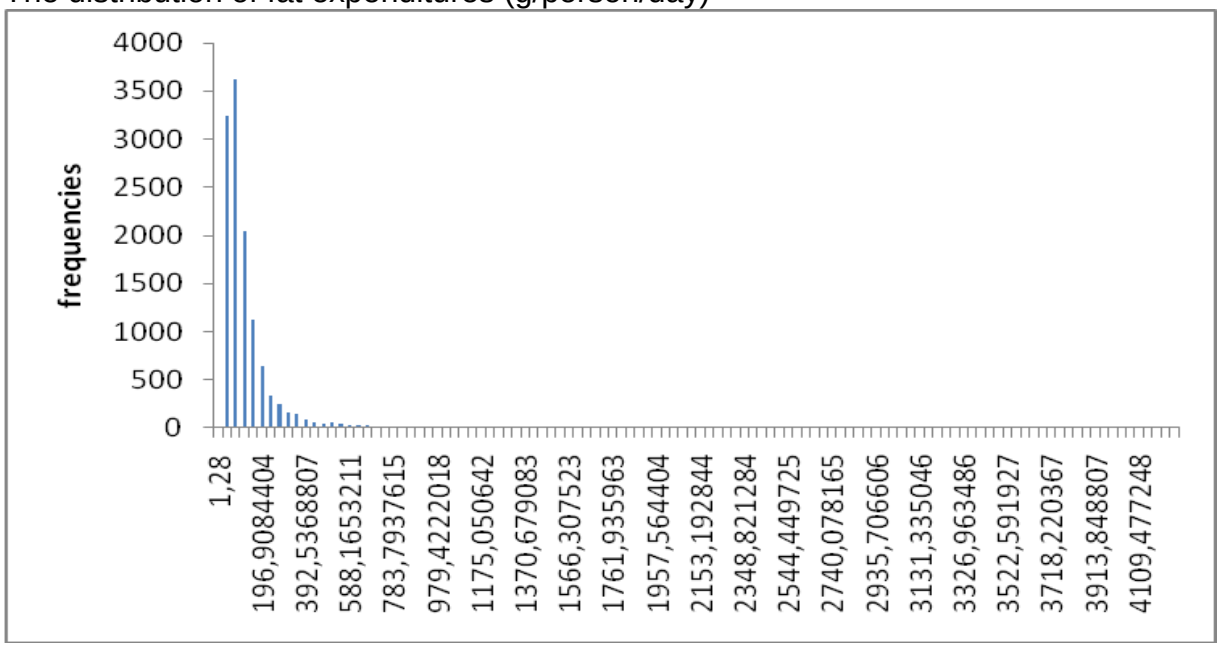
The distribution of protein expenditures (g/person/day)



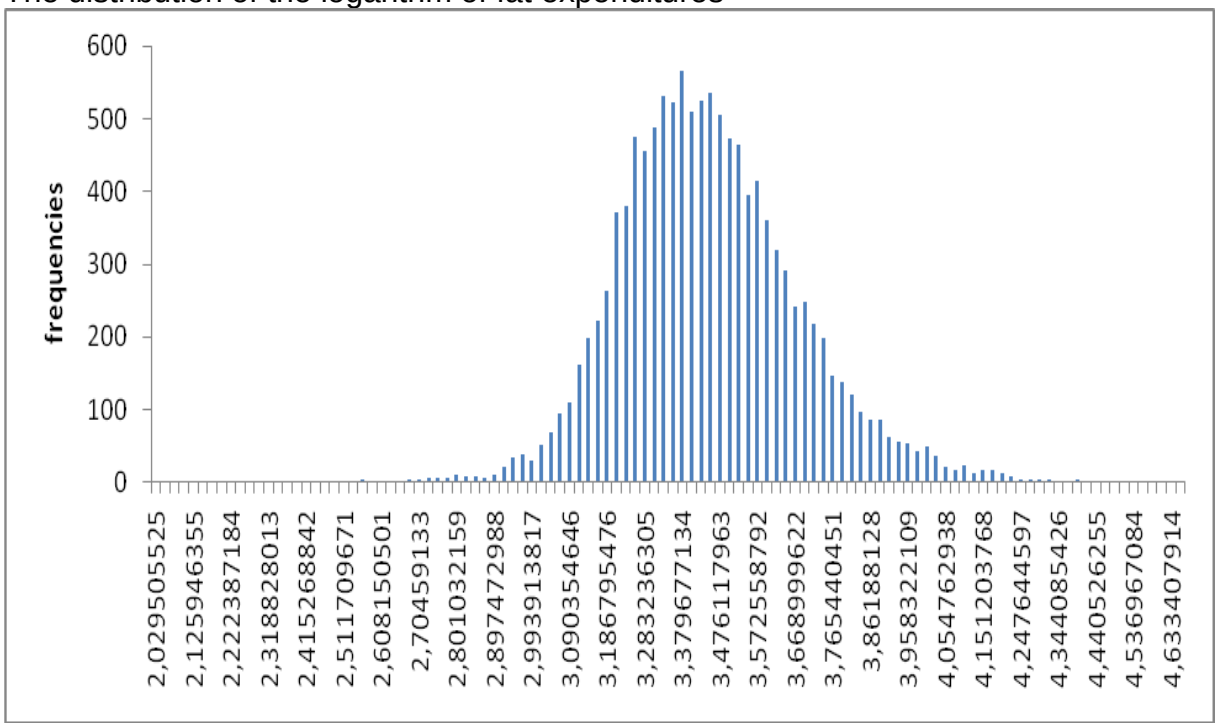
The distribution of the logarithm of protein expenditures



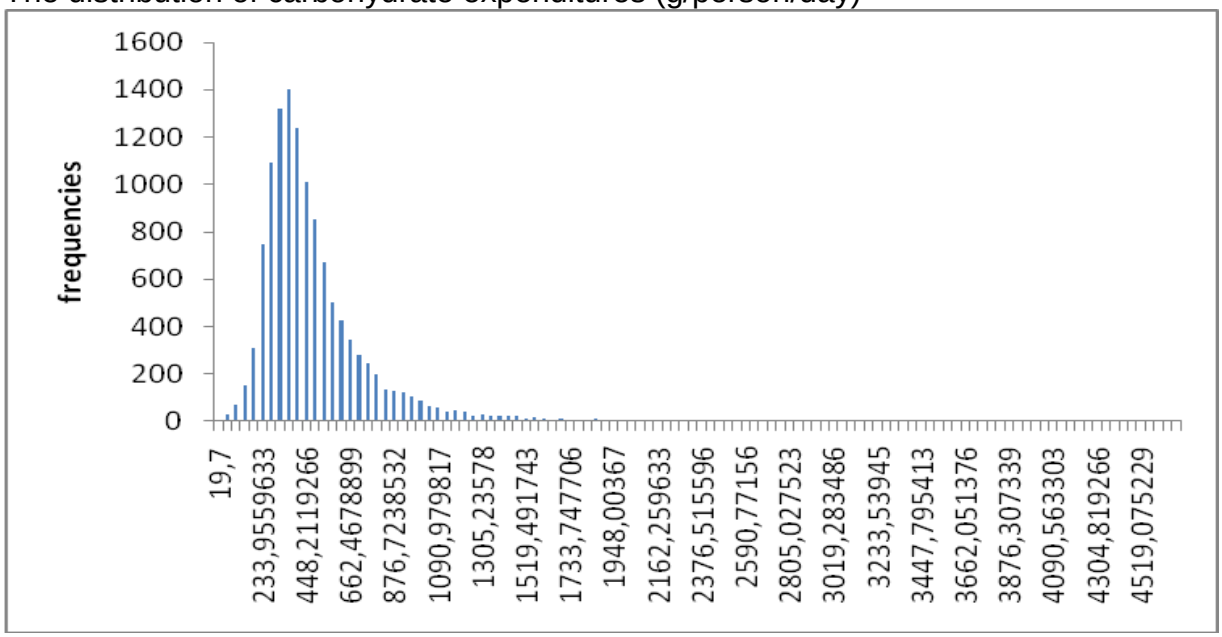
The distribution of fat expenditures (g/person/day)



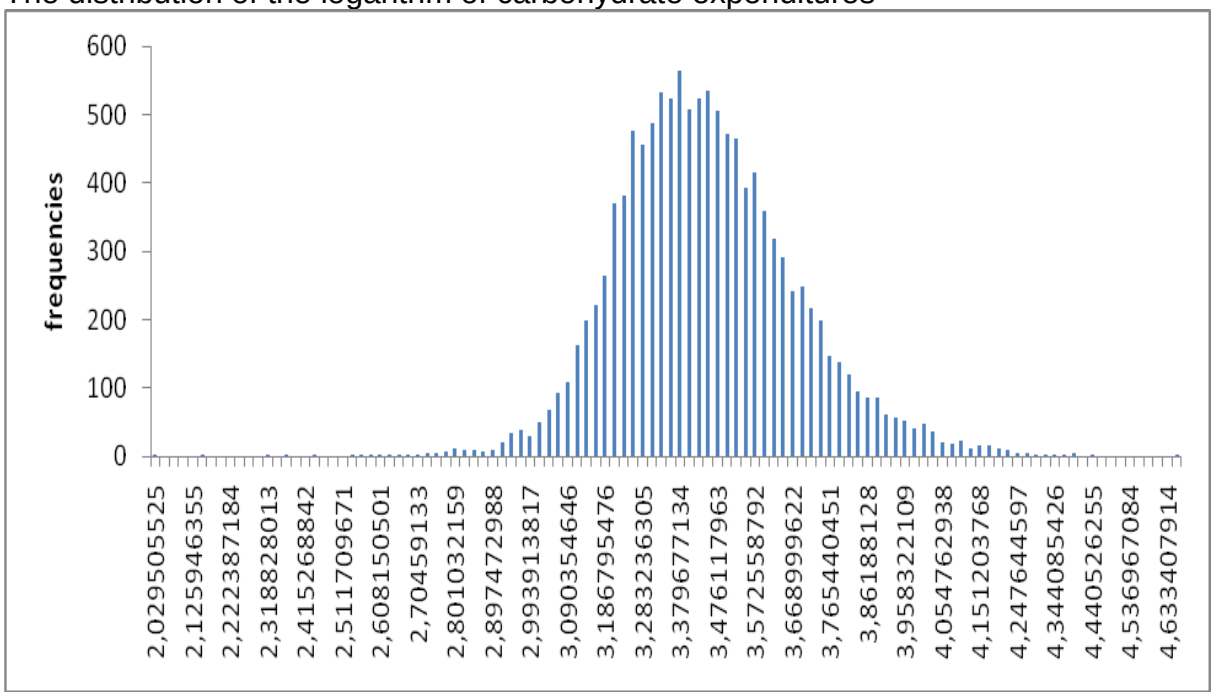
The distribution of the logarithm of fat expenditures



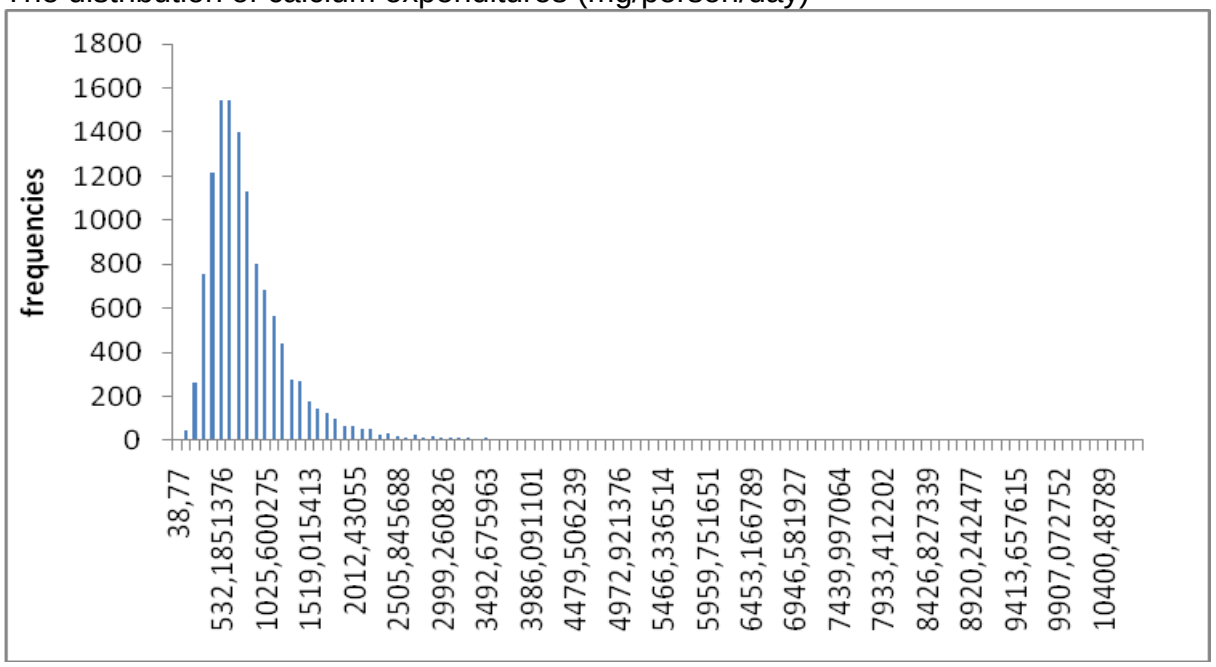
The distribution of carbohydrate expenditures (g/person/day)



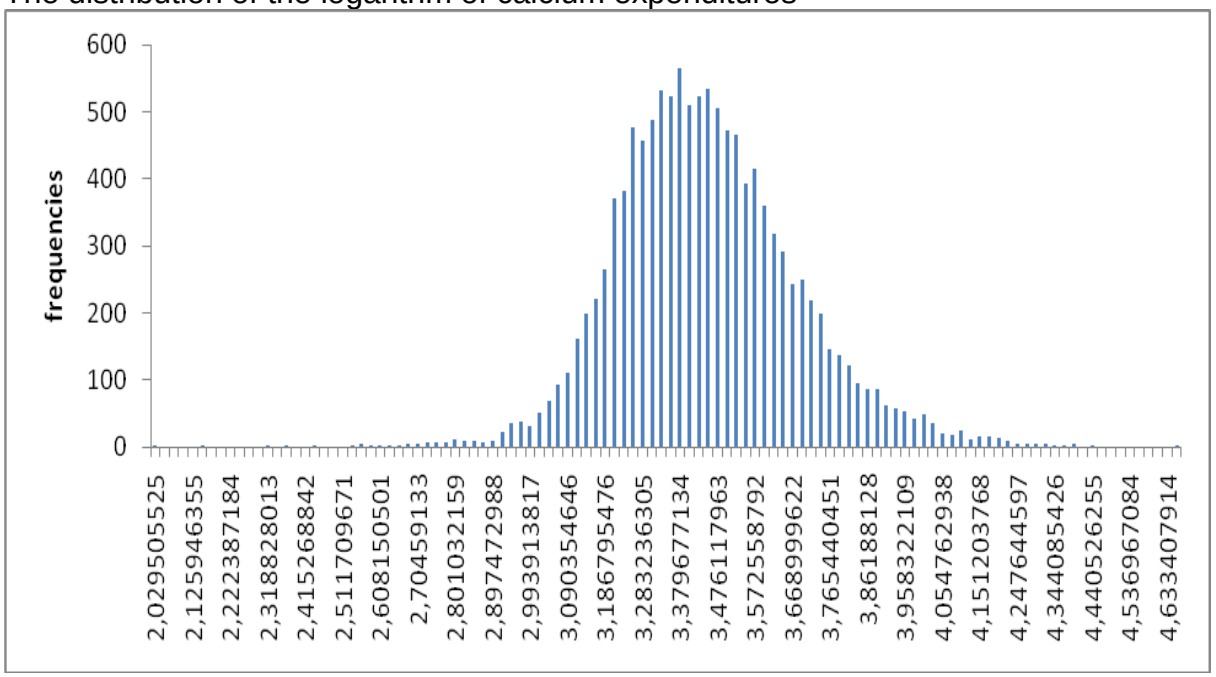
The distribution of the logarithm of carbohydrate expenditures



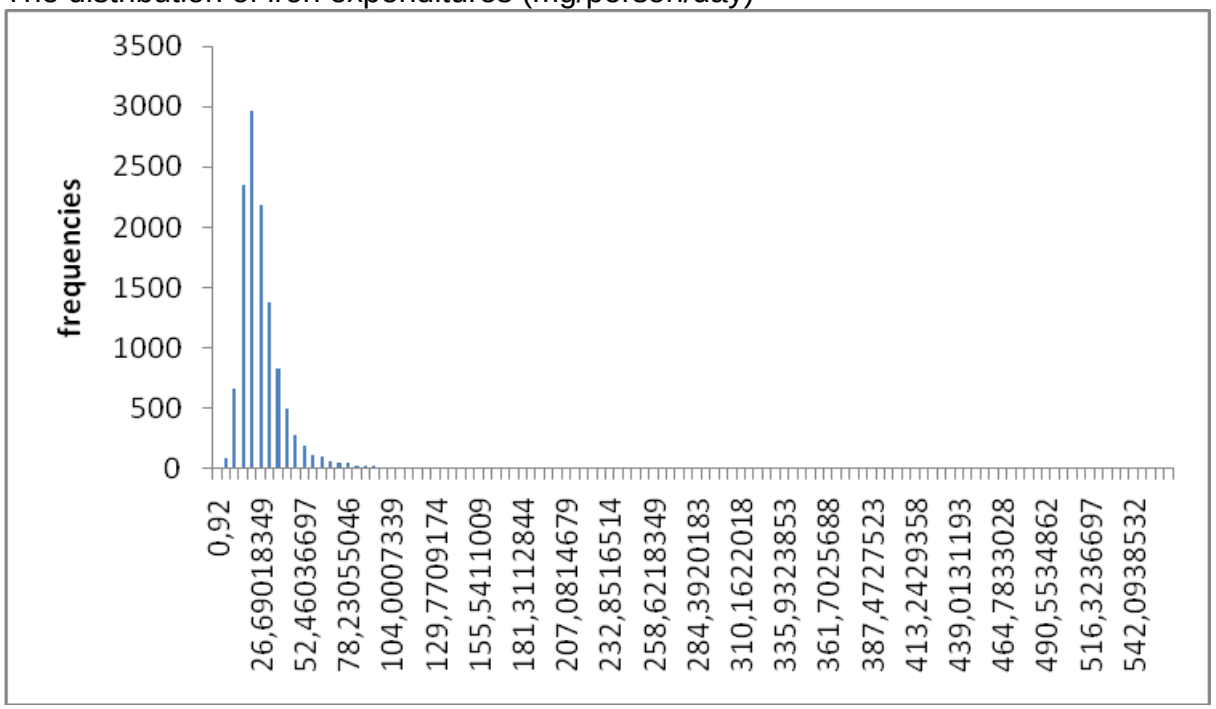
The distribution of calcium expenditures (mg/person/day)



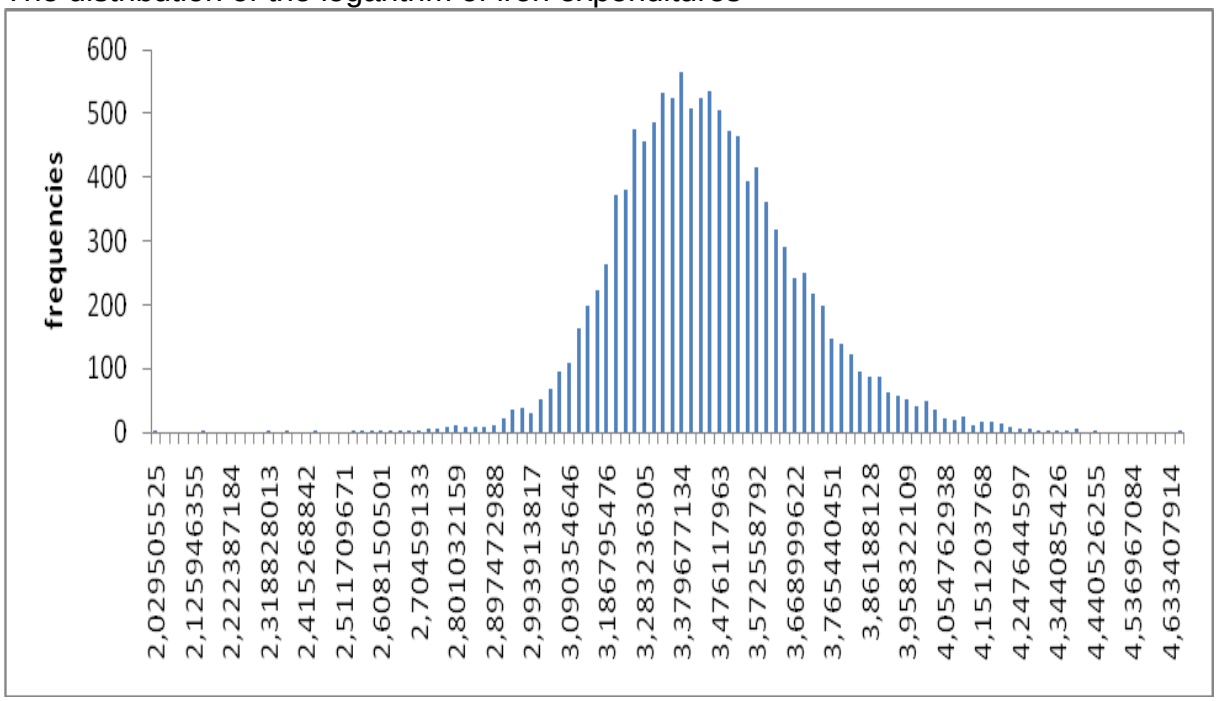
The distribution of the logarithm of calcium expenditures



The distribution of iron expenditures (mg/person/day)



The distribution of the logarithm of iron expenditures



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1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Professuren mit folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

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