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FOOD SECURITY IN RURAL LEBANON
Links with diet and agriculture

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Résumé

La présente étude fait partie d'un projet multidisciplinaire effectué à l'université américaine de Beyrouth. Elle est basée sur un échantillon de 798 individus dans trois communautés rurales libanaises ainsi qu'une analyse de marché et des politiques gouvernementales. Cette étude tente d'élucider si la qualité alimentaire est sacrifiée pour la quantité alimentaire dans une recherche de sécurité alimentaire. Une plus grande diversité alimentaire telle que définie par une consommation plus variée en groupes alimentaires est associée avec une plus grande sécurité alimentaire. En revanche, la collecte de plantes sauvages est associée à une plus grande insécurité alimentaire et l'auto-production d'aliments ne semble pas protéger de l'insécurité alimentaire. L'analyse des paniers normaux et « santé » montre qu'une alimentation diversifiée et plus saine est économiquement atteignable dans les communautés étudiées. Cependant, l'adoption de choix alimentaires plus sains est possiblement faite à l'encontre d'une politique gouvernementale qui n'encourage pas les aliments santé.

Abstract

As part of a larger interdisciplinary project at the American University of Beirut, this research is based on a survey of 798 individuals in three rural areas of Lebanon, a market survey and analysis of government policy. It asks if a trade-off is being made between food quantity and food quality in the attempt to achieve food security. More dietary diversity, measured by food groups, is found to be associated with greater food security; wild plant collection is associated with food insecurity due to problems of endogeneity; and self-production of food was not significantly correlated with food security. Analysis of normal and 'healthy' food baskets show that healthier, diverse diets are indeed within the economic reach of people in these communities, however the choice of better quality diets may be undercut by current government policies which unwittingly promote unhealthy foods.

Forward

A trans disciplinary thesis is no doubt best supervised by a team from different disciplines, which I have been fortunate to have. Thanks are due to Guy Debailleul for his optimism and open-mindedness along my long journey on often unfamiliar ground. Nader Kabbani went above and beyond the call of duty in supporting my foray into econometric analysis of food security and helped me to see it as on-going detective work. Rod MacRae gave me such interesting, informed and wise feedback that I have never doubted following his passion for building sustainable food systems. Last on the list but always first in my heart, Malek Batal openly shared his knowledge of the project he directed and the country he loves as well as his expertise in community nutrition, making it an incomparably rich learning experience for me.

Only the willingness of community members to participate in this action-research project made it possible and I sincerely hope that it represents one stepping stone on a path to sustainable livelihoods, balanced environments and good health. I owe heartfelt thanks to the EcoHealth program and team at the International Development Research Institute for their support of my field research.

Several other people have provided valuable input or support at crucial moments and deserve my thanks: Darine Barakat, Ahmad Abdallah, Ynesse Abdel-Malak, Peter Calkins and Katherine Gray-Donald. Finally, thanks and love go to my own family, the one I married into, and to friends too numerous to mention. Juggling this project and my two wonderful children would not have been possible without their help and support.

To my mother, who knew that life is a thing of beauty, and to my father, always a scientist.

Table of contents

List of tables

List of figures

Introduction

Global food systems, agricultural production and human diets have undergone fundamental transformations in the twentieth century as a response to predicted global food shortages, explosive population growth in the developing world, and the economic forces of globalization. High-input, high-yield agriculture as well as long-distance transportation have debatably made more people secure in terms of food energy and protein sources but have also increased the availability and affordability of refined carbohydrates including wheat, rice and sugar as well as edible oils. The resulting changes in consumption have been linked to emerging health problems, notably malnutrition in the form of both obesity and stunting and, despite energy consumption increases, diseases stemming from micronutrient deficiencies (Pinstrup-Andersen and Pandya-Lorch 1998). Termed the 'nutrition transition', these dietary changes have been fostered not only by economic and technological changes but also by the Westernization of developing country food systems and diets[1] (Uusitalo, Pietinen and Puska 2002, Chopra 2002).

Awareness has grown over the past few decades of the negative environmental consequences of intensive agriculture and of the need to modify systems and practices to prevent ecological destruction, including the loss of agro biodiversity (Matson and Parton 1997, Welch and Graham 1999, Thrupp 2000). More recently, attention has been drawn to the related problem of loss of dietary diversity and its impact on health and food security (Kennedy 2004, Ruel 2003, Heber and Bowerman 2001).

This research examines the linked issues of household food security (including income and employment generation), dietary diversity and consumable agro biodiversity in the context of several poor rural communities in Lebanon during at the beginning of the twenty-first century, a period of rapid and possibly double-edged globalisation. The central questions are whether there is a trade-off being made between food quantity and food quality in the attempt to achieve food security, and what the economic reasons for such potential trade-offs are. Do people sacrifice quality of food, and particularly food diversity, in order to avert hunger or cut their costs? Do those who gather or grow their own food make this

trade-off more, less, or differently? What policies, particularly agricultural and trade policies, may be interacting with household decisions to reduce biodiversity and dietary diversity?

Chapter 1 presents the research objectives, questions and hypotheses. The issues are introduced in a global context and then discussed in the specific context of Lebanon in Chapter 2. Chapter 3 presents the approach as well as methods of data collection and analysis. Chapter 4 describes the communities participating in the study, gives descriptive results and does multivariate analysis. Finally, Chapter 5 pulls together the research conclusions and links them to the implications of agricultural production and trade policies affecting food security, agricultural biodiversity and dietary diversity in Lebanon.

[1] The 'Western diet' is generally characterized by a diet high in saturated fats, sugar and refined foods and low in fibre (, 2003)

Chapter 1: Research Objectives and Questions

This research examines the linked issues of household food security, dietary diversity and consumable agro biodiversity in the context of poor rural communities in Lebanon, during a period of rapid and possibly double-edged globalisation. The central question is whether there is a trade-off between food quantity and food quality being made in the attempt to achieve food security.

1.1 Research Objectives

The present research is connected to a larger research project funded by Canada's International Development Research Centre and being carried out by the American University of Beirut's Department of Nutrition and Food Science, entitled *Wild Edible Plants: Promoting Dietary Diversity in Poor Communities of Lebanon*.

The general objective of the Wild Edible Plant action-research is the improvement of the health status of the rural and urban poor through the promotion of the preservation and sustainable use of wild plants at the national and regional levels. The project aims to "use culturally appropriate and sustainable practices to reverse unhealthy reliance on refined grains and non-traditional food imports and to investigate policy options to improve dietary diversity with governments and community-based organizations, based on the incorporation of wild edible plants in the diet" (internal project document, American University of Beirut).

The present study has two objectives:

1. To examine the relationship between food security and three factors: dietary diversity, collection of wild edible plants and self-production of food.

2. To identify the role that government policy may have played in the loss of dietary diversity, consumed agro biodiversity and wild plant consumption, and to identify policy options which could halt or reverse the trend.

1.2 Research Questions:

Three main research questions are accompanied by several secondary questions.

1. Are people sacrificing food quality (dietary diversity and 'healthy' diets) in order to avert hunger or cut costs, and does gathering or producing their own food help to mitigate that trade-off? Answering this broad question begs several background questions:

Food security: Do people enjoy food security according to experiential measures? Do they or their households experience hunger or deprivation, and if so to what degree?

Dietary Diversity: Do people have physical and economic access to diverse diets? What diversity does the market offer?

Self-production and collection of food: Do people grow or collect food themselves, with what frequency? Do households receive gifts of food from family or friends? Does collection of wild plants protect people against food insecurity? Or inversely, do only people suffering food insecurity resort to collecting wild plants? Does self-production of food protect people against food insecurity? Or inversely, do only people suffering food insecurity resort to significant home food production? Do people who grow their own food have greater dietary diversity?

2. What are the economic reasons for food quality versus quantity trade-offs? Is it more costly and/or more difficult for people in these communities to have diversified and healthy diets than non-diversified, unhealthy diets?

3. What role has government policy played in changes to agricultural biodiversity and dietary diversity in recent decades? More specifically, is the policy and distributive focus on quantitative food security compromising the qualitative aspect? What potential policies, especially agricultural and trade policies could help conserve agricultural biodiversity and dietary diversity?

1.3 General research hypotheses:

1. More dietary diversity and higher rates of self-produced and self-gathered food are associated with greater food security.

2. Healthier, diverse diets are within the economic reach of people in these communities.

3. A government policy focus on quantitative food security may be compromising qualitative food security

Chapter 2: Food security, diet and agriculture: the global context and rural Lebanon

2.1 Poverty, Hunger and Food Security

Poverty

Worldwide, more than 1.2 billion people live in extreme poverty and over 850 million people are chronically hungry, despite the existence of sufficient food at the global level. The 2000 Millennium Summit took as its goal to reduce by half the number of people living in extreme poverty and hunger by the year 2015 (FAO 2005). The FAO's State of Food Insecurity in the World 2003 already indicates that prospects of achieving that goal are bleak: from 1995-1997 to 1999-2000, the number of undernourished people actually increased by 18 million globally. The numbers of undernourished were reduced in Asia and the Pacific and Latin America, but rose in Sub-Saharan Africa, the Near East and North Africa (FAO 2003).

It is difficult to precisely determine the number of undernourished people in Lebanon. At present, the country does not have a nationally approved poverty line measured by income or consumption levels which can permit an accurate measurement of the share of the population living in absolute or relative poverty[2] and track progress achieved in reducing such levels. The United Nations' Millennium Development Goal indicator for extreme poverty is the percentage of individuals with an income of less than 1$US per day (base year 1990). While data does not permit calculation for this indicator, according to Lebanon's Central Administrations of Statistics, it is comparable to the share of the population living on less than 1.3$US per day in 1997, which was calculated to be 6.3%[3]. The closest approximation made to the MDG indicator for the percentage national income earned by the lowest quintile the population is the Central Administration of Statistic's

[2] Absolute poverty is the inability to cover the cost of basic food needs, while relative poverty is the inability to cover the cost of basic living needs including food, clothing, education and health (CRI and UNDP, 1998).
[3] This calculation is based on the proportion of people living in households with a monthly per capita income equivalent to the minimum monthly wage of 300 000 Lebanese liras (200 $US) or 60 000 LL (40 $US). The

calculation that in 1997, the lowest 17% of the population earned just 4% of national income (CDR/UN 2003).

In the absence of income or expenditure data, a 1998 UNDP study undertook a Mapping of Living Conditions in Lebanon using the Unsatisfied Basic Needs method. Using data primarily from a Population and Housing Survey carried out by the Ministry of Social Affairs and the UN Population Fund (1996), 11 indicators in 4 fields (housing; water and sewage; education; and income-related) were calculated. Results describe deprivation of satisfaction from selected basic needs, which implicitly include an indirect, approximate estimate of poverty as one element of a broader phenomenon. Thus "low" satisfaction does not necessarily correspond to "poor" nor "high" to "rich". The study calculates that 32.1% of households (and 35.2% of individuals) live below the satisfaction thresholds, with the following detailed breakdown:

Table 1: Degree of household satisfaction in Lebanon

Degree of household satisfaction	*%*
Very low	7.1
Low	25
Intermediate	41.6
High	21.9
Very high	4.5

Source: Mapping of Living Conditions in Lebanon, MOSA/UNDP, 1998

These studies reveal significant regional disparities, with the poorest areas being rural, in addition to some poor pockets in cities and suburbs. For example in Hermel, one of the communities included in our study, two-thirds of households are living in low satisfaction versus the national average in that category of 32.1% (MOSA/UNDP 1998). Since the creation of Lebanon, Beirut has dominated the rest of the country. While planning policies in the 1960s succeeded in improving the situation in the regions, the 17-year civil war exacerbated regional differences and the gap between Beirut and the rest of the country is

CAS also calculated that 18% of the population lived on less than 2.2 $US per day (1997), while a 2002 study concluded that 7.1% of the population lived under a 'poverty line' of 2.2$ per capita per day.

still sharp (Harb 2000). Lebanon's Gini index of 0.435 (according to a Central Administration of Statistics 1997 study) indicates a relatively unequal income distribution[4].

While deprivation is more acute in rural areas, a greater proportion of the deprived population lives in urban than rural areas. Thus 57% of the deprived population live in urban kadas (districts) with 25.3 residing in Beirut and its suburbs. Most of the deprived urban dwellers have moved from deprived rural areas.

The following two tables present the scores for living conditions in all kadas, with the three rural kadas where the communities in our study are located highlighted in red. While the first table gives a general breakdown (low-medium-high), the second gives a more detailed one.

[4] In a perfectly egalitarian society, the Gini would be 0 while in a a perfectly unequal society in which one person/family had all the income, the Gini would be 1. In most developed European countries, the Gini generally falls between 0.24 and 0.36 while the US coefficient is above 0.4 (http://wikepedia.org/wiki/Gini_coefficient).

Table 2: Living Conditions in Lebanon: Degree of household satisfaction[5] by kada

Kada (district)	*Low*	*Intermediate*	*High*	*Total*
1.Bent-Jbeil	67.2	28.5	4.3	100
2.Hermel	65.9	28.6	5.6	100
3.Akkar	63.3	29.1	7.6	100
4.Marjaayoun	60.0	32.3	7.6	100
5.El-Minieh	54.2	39.3	6.5	100
6.Baalbeck	49.2	40.1	10.7	100
7.Tyre	45.0	41.0	14.0	100
8.Hasbayya	41.5	48.4	10.1	100
9.Nabatieh	40.0	47.4	12.6	100
10.Rachayya	39.5	51.9	8.7	100
11.Jezzine	35.7	49.8	14.5	100
12.Tripoli	34.9	38.2	26.9	100
13.Becharry	34.8	45.4	19.8	100
14.Batroun	34.2	45.0	20.8	100
All Lebanon	**32.1**	**41.6**	**26.4**	**100**
15.Baabda	31.6	42.2	26.1	100
16.Chouf	31.0	50.0	19.0	100
17.Western Bekaa	30.7	53.6	15.8	100
18.Jbeil	30.1	46.7	23.2	100
19.Zgharta	29.7	43.0	27.3	100
20.Saida	29.7	47.2	23.0	100
21.Zahle	28.9	45.3	25.8	100
22.Koura	27.0	44.7	28.3	100
23.Aley	25.0	45.6	29.3	100
24.El-Metn	19.7	43.9	36.4	100
25.Beirut	18.4	38.7	43.0	100
26.Kesrouan	13.5	38.3	48.2	100

Source: MOSA/UNDP, 1998

Table 3: Distribution of households by living conditions index in seven most deprived kadas, compared to the least deprived kada (Kesrouan) and national average

Kada	*Very low*	*Low*	*Below threshold*	*Intermediate*	*High*	*Very high*	*Total*
Bent-Jbeil	20.0	47.2	67.2	28.5	4.1	0.2	100
Hermel	26.1	39.7	65.9	28.6	5.6	-	100
Akkar	23.3	39.9	63.3	29.1	7.1	0.4	100
Marjaayoun	18.9	41.2	60.0	32.3	7.1	0.6	100
El-Minieh	12.7	41.5	54.2	39.3	6.2	0.3	100
Baalbeck	12.4	36.8	49.2	40.1	10.2	0.5	100
Tyre	9.89	35.1	45.0	41.0	12.6	1.5	100
All Lebanon	7.1	25.0	32.1	41.6	21.9	4.5	100
Kesrouan	2.0	11.5	13.5	38.3	35.7	12.5	100

Source: MOSA/UNDP, 1998

[5] See p. 15 for definition of 'household satisfaction'.

Food security and hunger

While poverty, hunger and food security are closely interrelated issues, their causes and consequences are not identical. Food security is widely described as the situation that exists when all people, at all times, have physical, social, political and economic access to sufficient, safe, nutritious and personally acceptable food in a manner that maintains human dignity[6]. In a long-run, comprehensive perspective, the satisfaction of five components (the five 'A's) are necessary to achieve food security (MacRae 2004):

1. Availability: sufficient supplies of food for all people at all times

2. Accessibility: physical and economic access to food for all at all times

3. Acceptability: culturally acceptable and appropriate food and distribution systems

4. Appropriateness: nutritional quality, safety and sustainability of available sources and methods of food supply

5. Agency: policies and processes to enable actions which ensure the previous four elements of food security

Clearly, even achieving the two most direct and commonly cited aspects of food security, availability and access to food, is a long way from becoming reality. But achieving lasting food security involves simultaneous work on all five components, complex as that task may be. As the examples of environmental degradation (loss of soil fertility, water pollution) and micronutrient deficiencies indicate, the benefits of advances in one dimension, such as food production, can be negated by impacts in another when we neglect to do so.

Economic approaches to food security initially focused on evaluating aggregate levels of food supply, agricultural production and trade balances. In the 1970s, food security was defined as avoiding short term food supply deficits through national and global grain

[6] This definition is broader than that used by some; for example, according to the FAO's Food Insecurity and Vulnerability Information and Mapping Systems site, 'Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. (http://www.fivims.net/static.jspx?lang=en&page=overview) Food insecurity denotes "the limited, inadequate, or insecure access of individuals and households to sufficient, safe, nutritious, personally acceptable food both in quality and quantity to meet their dietary requirements for a healthy and productive life" (Tarasuk 2001).

storage and surviving transitory weather shocks to supply such as droughts, market failure and civil strife. But the ongoing existence of malnutrition despite stabilized world food supplies indicated that aggregate food supply is not a useful proxy for household or individual level food supply: food insecurity exists at the household level even in the absence of regional or national food insecurity (Gittlesohn et al 1998). Even when national food supply and demand are balanced, households can suffer from food insecurity because they have no way of expressing their full need for food on the marketplace, lacking 'entitlement' to food (following Amartya Sen's seminal work)[7] or effective demand (Thompson and Metz 1998).

Economic, social and cultural factors influence food security and can be chronic or transitory. Chronic food insecurity occurs when individuals or groups suffer from food insecurity on an ongoing basis while transitory shocks to household food security include drought, pest attack and sudden unemployment. Food secure households are more able to withstand shocks to their food entitlements, whether the entitlement is based on production, own-labour, trade or transfers from governments or other individuals (Thompson and Metz 1998). Social mechanisms such as loans or food gifts can help to alleviate shocks, however coping strategies such as resorting to food aid, scavenging or stealing can violate the principle of acceptability (the third 'A' above) in achieving food security.

Food security at one level (national, regional, household, individual) does not imply food security at another. Within households, cultural factors influence food allocation; for example, who gives up food when there is not enough to go around. At the individual level, food security is achieved if a person's food consumption is greater that his or her physiological need. Although need is identified at the individual level, the household is commonly the unit of analysis because it is considered to be the basic economic unit determining the individual's level of consumption. However, this assumes that income comes to the household unit as a whole, with decisions made at the household level and consumption divided among household members in some relation to need. On occasion, none of these assumptions are valid (Thompson and Metz 1998). Research in Bangladesh

[7] Entitlement in Sen's work means the power of the individual to command (resources to buy or grow) food . Such entitlements give individuals control over the resources they can use within the rules and regulations of

indicates that women and men in the same households respond differently to household-level food security questions, with a concordance rate of 81%. Disparities in response were mainly related to gendered spheres of household responsibility, power imbalances affecting intra-household food allocation and different attitudes to food-related vulnerability (Webb, Coates, Frongillo, Rogers, Swindale and Bilinsky, 2006).

Hunger and food insecurity are often considered to be part of a more general problem of income-determined poverty, but households which are counted as income-poor are not necessarily food insecure. One possible reason for this in rural communities is the ability to grow or collect one's own food. Conversely, households facing food insecurity are not necessarily poor, but may rather suffer from transitory factors such as uneven incomes, transport problems, changes in household composition during the year, or disruptions from wars, occupations or natural disasters (Kabbani and Wehelie 2004, R. MacRae personal communication 2001). Research comparing poverty and food insecurity is scarce.

A direct/experiential food security survey has to our knowledge never been carried out in Lebanon. However, it has been suggested least-cost nutritionally adequate diets may be beyond the reach of families of low socio-economic status in Lebanon, since data has shown that the cost of such diets is higher than the prevailing wage for the lowest income bracket (Baba 1998).

Research has recently been carried out, mainly in industrialized countries, into the phenomenon of 'food deserts', a term coined to describe areas of inner cities where cheap and nutritious food is unavailable, such that car-less residents unable to travel to large supermarkets are faced with high prices, processed products and low quality or non-existent fresh fruits and vegetables (Cummins and Macintyre 2002). Several studies in the UK and US in the 1980s and 90s reported that:

> -healthy food is more expensive and less available in deprived areas than affluent ones
> -small independent stores are more expensive than large, multiple-owned outlets

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society, to satisfy needs including food needs.

> -in general, 'healthy' food and diets are more expensive than 'unhealthy' food and diets, when purchased from the same food retail outlets or areas. (Cummins and Macintyre 2002, Ellaway and Macintyre 2000).

However, Cummins and Macintyre's 2002 study in Greater Glasgow found that shop type was the main predictor of food price and availability, prices did not generally vary according to area deprivation and when they did, they actually tended to be lower in deprived areas. Similar findings have been reported in a study of neighbourhoods in Montreal, Canada in which store size was the only predictor of the cost of a nutritious food basket (Duquette et al 2006). However, the Glasgow study found that cheaper foods in deprived areas were predominantly high-fat, high-sugar types.

While industry and consumer market studies, including many studies of food deserts, have generally tried to replicate a 'typical' consumer shopping basket (Chung, Myers and Samuel 1999, Guy and David 2004), several recent studies have focused on market surveys of 'healthy' foods or compromises between nutritious foods and commonly-eaten foods (Donkin, Dowler, Stevenson and Turner1999; Rex 2003; Guy 2004). In Guy's study, 'healthy food' was defined as "foods that are widely held to be nutritious and are substantially free of saturated fats, sugar and/or salt".

Despite the presence of large supermarket chains, the large variety of imported products available and the absence of traditional farmers' markets, food retailing in Lebanon retains many aspects of developing country retailing (as described by Paddison, Findlay and Dawson 1990). Food retailing is dominated by the small-scale retailer, with only 137 supermarkets larger than 200 square meters in the country (Ministry of Economy and Trade, internal document 2005). Small food retailers include variety stores, fruit and vegetable stores, butchers, fish shops and bakeries. In addition, there are many informal traders selling food from carts. As in many developing countries experiencing urban migration, the 'surplus population' in cities is forced to generate its own employment. In Lebanon, the presence of thousands of Syrian workers, who are generally exempted from obtaining work permits or paying taxes, adds to the number of fruit and vegetable retailers and carts.

No food basket survey is published at present in Lebanon. The Ministry of Economy and Trade calculates and publishes monthly consumer price indexes indicating price changes in food categories but not individual foods. The Central Bureau of Statistics carried out surveys in 1995 (published in 1997) and 2003 (not yet published), including detailed information about volumes and spending on an exhaustive list of food items in Lebanon. However, surveys were limited to the urban areas and suburbs of Beirut.

2.2 Nutrition and Dietary Diversity

Nutrition

At the global level, there is increasing evidence pointing to a 'double burden' (WHO 2002): malnutrition - especially micronutrient deficiencies - combined with problems of excess energy intake with little nutrient density, predisposing people to obesity, diabetes, cardiovascular diseases and cancer. Obesity and under nutrition have even been found to exist simultaneously within some poor households (Chopra 2002).

Micronutrient deficiencies[8] such as iron deficiency anaemia are major public health problems in both industrialized and non-industrialized countries, with high rates of anaemia and stunting occurring particularly in poor populations. Micronutrient malnutrition, often termed 'Hidden Hunger', is estimated to affect over 2 billion people globally. In addition to specific problems stemming from such deficiencies (anaemia, goitre, eye problems), inadequate nutrition can compromise immune function, cognitive development, growth, reproductive performance and work productivity, as well as contributing to chronic diseases (Underwood 2000, Welch and Graham 1999).

Roughly 2 billion people globally are affected by iron deficiency, 1.5 billion are at risk of iodine deficiency and 250 million risk vitamin A deficiency (Bread for the World Institute 1996 in Pinstrup-Anderson and Pandya-Lorch 1998). Numerous studies have highlighted the impact of iron deficiency on the cognitive development of children resulting in developmental delay that is often irreversible (see for example Lozoff et al. 1991).

Resource-poor women, infants and children in developing countries are particularly at risk from nutritional problems (Welch and Graham 1999). The World Bank estimates that at 1994 levels of micronutrient malnutrition in South Asia, as much as 5% of gross domestic product is lost each year from deficiencies in iron, vitamin A and iodine (McGuire and Galloway 1994).

Simultaneously, of the 45 million adult deaths worldwide in 2002, nearly three-quarters were caused by noncommunicable diseases (NCDs), many of which are linked to obesity (WHO 2003). Causes of death vary widely across regions: in Africa only one out of three deaths were caused by NCDs, compared with almost 9 out of 10 in developed countries. Yet while over-nutrition and NCDs are commonly perceived as rich country problems, they are increasingly present even in countries where hunger is endemic. Levels of overweight in Mexico, Egypt and South Africa, for example, are equal or greater than those in the United States (s 2003) and in rural and urban areas of Tanzania, stroke mortality rates are three times higher than England and Wales. Obesity has emerged as a major public health problem very rapidly in some countries: rates of annual increase in the prevalence of overweight and obesity are two to five times greater in Asia, North Africa and Latin American as in the US (s 2003).

Unhealthy diets and insufficient physical activity are among the major causal factors in NCDs. Studies have found a consistent relationship between unhealthy diet and the emergence of chronic non-infectious disease: coronary heart disease, cerebrovascular disease, cancers, diabetes, dental caries, bone and joint diseases (Uusitalo et al 2002). Evidence suggests that foetal malnutrition is a threat to survival, growth and development in childhood as well as increased risk of chronic disease in adult life, further demonstrating the link between under and over nutrition (Kennedy, Nantel and Shetty, 2006).

The ‘nutrition transition’ toward high-fat, high-sugar diets in most developing countries has historically begun with major increases in production and imports of oilseeds and vegetable

[8] Micronutrients are vitamins and minerals needed in small amounts to support physiological functions that must be provided in foods or as supplements because they cannot be made by the body in amounts sufficient

oil (s 2003). Secondary to this change is an increase in consumption of animal and dairy products. In China, for example, the share of energy from animal protein increased from 3.1% to 18.9% in 40 years (Uusitalo et al 2002). Information from the UN's food balance sheets showing annual food supply by country indicates a clear increase in energy density of diets worldwide. Meanwhile, the most important elements in the dietary prevention of cardiovascular disease and cancers are fruit and vegetables consumption and the amount and quality of fat and salt intake (Lock, Pomerleau, Causer, Altman and McKee 2005, WHO 2002).

Westernized high-fat, high-sugar diets are pervasive in newly urbanized populations, associated as they are with modernity, saving preparation time, convenience, and the sometimes high value for money of street and fast foods (Chopra 2002). The nutrition transition is also related to shifts in work environments as more women work outside the home and street vendors become the fast-food restaurants of the urban poor (Uusitalo et al 2002). The urbanization process is linked to changes in diets and markedly reduced physical activity, due in part to greater access to motorized vehicles, mass transportation and penetration of televisions in homes (s 2003). Obesogenic environments provide easy access to fast and ready-to-eat food and soft drinks while requiring little physical activity. Urbanization has also generally been accompanied by greater consumption of 'new' grains such as rice and wheat instead of corn or millet, as well as a transition to more milled, polished grains. Ready-made bread is often found to be more convenient and less time-consuming to prepare than traditional cereals and root staples (Uusitalo et al 2002).

The overproduction of agricultural produce in countries of the global North, along with the relative inelasticity of food demand, have contributed to a push for adding value to raw agricultural products or even replacing them with cheaper ingredients. Foods are stripped of their nutritional content (white bread, white rice) and supplemented with chemical additives (colourings and flavourings), sugar, salt and oils (Chopra 2002). Food advertising uses emotion and social desires to sell its products, targeting different populations with different styles. Television promotion aimed at children, for example, promotes primarily sugared cereals, candy and other snacks, all with high sugar content (Mintz 1985). A

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to meet needs. (Underwood, 2000)

biological fondness for sweetness, agricultural transformations including urbanization, and commercial interests together provide powerful explanations for the nutrition transition.

Thus while lower food prices make food more accessible for the poor, low prices for high-fat, high-sugar food also have negative impacts. Traditional diets rich in grains and fibre are being abandoned in favour of diets high in sugars, oils and animal fats. This is not simply the effect of increasing incomes, as the transition to energy-rich diets is occurring at a much lower income levels than previously. A diet deriving 20% of its energy from fat was associated with a GNP of US $1475 in 1962 but only 750$ in 1993 (2003). Drivers for this phenomenon include greater income, relative price changes caused by institutional[9], technological and policy changes, and socioeconomic changes related to urbanization, notably ease of access to energy-rich food (Haddad 2003). Two of the very few studies linking chronic disease and obesity to relative price changes indicate that 40% of the weight increase in the US population between 1976 and 1994 was due to technology-induced food price decreases (Haddad 2003).

Global increases in the rates of chronic disease seem to be particularly linked to the quantity and quality of fat consumed by the population. Higher consumption of dietary fat, coupled with a greater reliance on highly processed, poor quality vegetable oils, is becoming an increasingly important contributor to such diseases in low and middle income countries. These poor quality oils are often displacing healthier sources of energy, including locally produced, better quality fats. The agricultural, industrial, marketing and consumer forces driving this change as well as the links between these forces are not well elucidated, nor are the ecosystem, economic and human health implications well understood.

The “nutrition transition” throughout the world has been characterized by increased dietary fat, among other changes, and the increased consumption of vegetable oils has been identified as the first indicator of this process (Drewnowski and 1997). The impact of these dietary changes on quantities and qualities of fat consumed is difficult to estimate as the vegetable oils may be processed in ways not readily perceived by the consumer (for

[9] Such as trade policy governance or changing mechanisms of food distribution

example, hydrogenation with further incorporation into various recipes) and not documented in food composition tables.

Poor quality dietary fats are increasingly consumed, even where indigenous, healthy fats are available. Consumption of poor quality fats is the most consistent dietary risk factor for cardiovascular disease with poor quality fats defined as high in saturated fatty acids and trans-fatty acids, low in polyunsaturated fatty acids (with a high omega 6/omega 3 ratio) and low in monounsaturated fatty acids (Reddy and Katan 2004).). The reasons consumers make their fat choices are poorly understood, but appear to be a combination of availability, price, convenience, preference, culture, marketing strategies and advertisement (Uusitalo et al, 2002).

Dietary diversity

Dietary diversity has long been recognized as essential to high quality diets. Dietary recommendations in numerous countries promote an increase in dietary diversity along with, more recently and in response to obesity epidemics, a decrease in consumption of certain nutrients such as fats, refined sugars and salt (Kennedy 2004, Nestle 2002). The issue of dietary diversity is particularly important in poor populations with diets based on starchy staples and including few animal products, fresh fruits or vegetables (Ruel 2003). Greater dietary variety has been associated, either directly or indirectly through increased intake of micronutrients, with improvements in areas including birth weight, child anthropometric status, haemoglobin concentrations, incidence of hypertension, cardiovascular disease and cancer (Hodinott and Yohannes, 2002).

Several studies (see for example Heber and Bowerman, 2001) have linked nutritional problems to a lack of diversification in diets and a focus on few staple foods. Globally, 80% of total energy intake is being provided by eight plants (barley, maize, millet, rice, rye, sorghum, sugar cane and wheat) and four tubers (cassava, potato, sweet potato, and yam)(Grivetti and Ogle 2000). Four of those (wheat, maize, rice and potato) provide over half the food-based calories in the human diet (FAO 2004).

There is also increasing recognition of the value of variety in food functionality (non-nutrient properties of food such as fibre, fat, and phytochemicals including antioxidants, anti-inflammatory constituents and immunostimulants). Many of the benefits of non-nutrients are substantial and have longstanding traditional reputations and use in different parts of the world (Ruel 2003).

Scant research has been carried out on the association between dietary diversity and household socioeconomic characteristics and/or food security (Ruel 2003). In an analysis of 10 countries, Hoddinott and Yohannes tested whether household dietary diversity is associated with household per capita consumption[10] (considered a proxy for household income) and energy availability[11] (considered a proxy for food security), with the objective of using dietary diversity as a low-cost, easy to administrate indicator of food security. They found that a 1 percent increase in dietary diversity is associated with a 1 percent increase in per capita consumption, a 0.7 percent increase in total per capita availability, a 0.5 percent increase in household per capita daily caloric availability from staples and a 1.4 percent increase in household per capita daily caloric availability from non-staples. Thus as households diversify their diets, they tend to increase the variety of prestigious non-staple foods rather than diversifying within staple foods (Hoddinott and Yohannes 2002). Consumption of the poorest households has been shown to be the most responsive to increases in income (Haddad 2003); however there is no suggestion that income increases are the only way to diversify diets.

The problem of 'Hidden Hunger' (micronutrient deficiency) is that even when caloric intake is sufficient, nutritional deficiencies can be severe enough to cause crippling health problems (Welch and Graham 1999). The apparent global paradox of obesity occurring simultaneously with food insecurity can be partly related to the cost of an optimum diet: households with limited incomes may be trying to maximize the energy per dollar spent (Kennedy 2004). This problem could be relevant only for urban or market-based economies. Studies of existing hunter-gatherer populations in Australia indicate that

[10] Consumption is defined as the value of household consumption of food and nonfood goods.
[11] Caloric availability is defined as the amount of food consumed by all household members over the last seven days.

individuals consume over 800 different varieties of plant-based foods and develop nutritional deficiencies when they move to urban areas (Heber and Bowerman 2001).

It is important to consider the social and ecological determinants of dietary diversity because a diversified diet takes on different forms depending on the context. In some cases, introducing or reintroducing different meat products in the diet can enhance protein and iron uptake, often scarce in cereal-based diets. In other cases, vegetables and fruit uptake should be promoted in order to provide supplemental sources of micronutrients. Diet diversification may be linked to hunting and gathering or to the cultivation and domestication of wild plants and animals, according to local possibilities. Traditional knowledge is an important resource to assess the value of food that was once part of the diet.

The double burden of nutritional deficiencies combined with excess energy intake can be clearly seen in Lebanon. Although the relationship between the prevalence of diseases related to over consumption and diet has not to our knowledge been studied in the country, Baba (1998) cites unpublished data reporting that heart disease is the number one killer in Lebanon and that the incidence of diabetes is similar to the developed world.

At the same time, growth retardation is common among the poor in Lebanon. Micronutrient deficiencies, particularly iron deficiency anaemia and iodine deficiency disorders such as goitre, are present in important numbers and deficiencies of micronutrients including iodine, magnesium, zinc and calcium have been reported for all age groups (Baba 2000). Recent studies have found a 24.8% prevalence of iron deficiency anaemia among children under 5 years of age, while women of child-bearing age showed a prevalence of 13.5% of anaemia and 33% of iron deficiency (Hwalla, Adra and Jackson, 2004)

A study of Lebanese women of childbearing age and low socio-economic status found anaemia to be prevalent in 16.6% of the sample, though the majority were only mildly anaemic. Comparisons of haemoglobin and ferritin deficiencies between Lebanon and other countries show Lebanon to have higher deficiency rates than the US and European countries, but lower rates than Jordan, Turkey and Egypt (Khatib 2004).

Food balance sheets from the United Nations Food and Agriculture Organization (FAO) indicating the food present in a country (calculating production, imports, exports and stocks) are available for Lebanon from 1961 to 2003[12]. Food balance sheets do not reflect the distribution of food commodities among different socio-economic groups, ecological zones and geographical areas. Because they do not necessarily represent the actual consumption by the population, they should be complimented by food consumption surveys. In Lebanon, such surveys are rare and have generally been carried out only on specific populations in particular regions, and are thus unlikely to accurately represent intake in the country as a whole.

The FAO food balance sheets indicate that the past 30 years have seen a decrease in the intake of carbohydrates, especially bread and cereal, and increased intake of fat, milk and animal protein. During the period from 1961-3 to 1998, the contribution of carbohydrates to daily intake decreased from 64.8% to 52.9%, while fat contribution rose from 24 to 34.3% (Baba 2000)[13]. The available information on household food consumption in Lebanon between the 1960s and recent years, although rare and region-specific, correlates with the global pattern of decreased cereal intake and increased consumption of fats and protein in both urban and rural populations[14] (Baba 1998).

[12] A rural census was undertaken for the first time in Lebanon in 1998. According to sources at the Ministry of Agriculture, any data preceding the census must be an estimate.

[13] The article does not indicate the increase in protein consumption. However the FAO Stats data base shows an increase in protein intake between 1961 and 2003 of 44.5% for Lebanon. During the same years, overall calorie intake increased by 34.5% and overall fat intake increased by 84.4% (FAO Stats, Food Balance Sheets 2006)

[14] Although the consumption of protein increased from 62.3 g/capita/d in 1961-63 to 81.2 g/capita/d in 1990-92, the percentage energy from proteins remained stable at 11% while the percentage energy from fat increased from 22 to 26% (Baba 1998)

Table 4 : Average food availability, different food groups, 1961 - 2002

	*1961-63**	*1971-73**	*1981-83**	*1990-92**	*2001***	*2002****
% energy from:						
Cereals	49.3	45.7	39.9	36.4	37.2	32.3
Roots and tubers	1.3	1.7	3.2	3.6	5.0	4.9
Pulses, nuts, oil seeds	5.6	4.6	6.8	6.8	5.6	10.1
Fruits, vegetables	9.6	9.5	8.8	14.4	9.05	10.0
Meats, fish, dairy, eggs	10.9	11.1	14.4	10.5	21.4	14.7
Oils, fats	11.3	12.7	14.4	15.6	6.8	14.9
%protein from:						
Cereals	50.1	48.1	37.3	37.1	26.9	30.6
Roots and tubers	0.8	1.1	1.8	2.2	1.5	2.8
Pulses, nuts, oil seeds	9.7	7.9	13.6	12.6	4.0	13.9
Fruits, vegetables	8.1	8.3	7.6	14.6	4.7	9.8
Meats, fish, dairy, eggs	29.8	32.6	37.5	31.6	55.7	39.1

** Hwalla (Baba), 1998.*
*** Hwalla (Baba), 2001*
**** FAOSTAT food balance sheets.*

Table 5: Net energy and protein supply per capita per day in Lebanon, 1961-2002.

/capita/day	*1961-63**	*1971-73**	*1981-83**	*1990-92**	*2002***
Kcal	2396	2319	2844	3144	3196
Protein (g)	62.3	58.2	80.2	81.2	88.5
Animal protein (%)	29.8	32.6	37.5	31.6	39.1

** Hwalla (Baba), 1998.*
*** FAOSTAT food balance sheets, 2004.*

The case of wheat is of particular interest as it was and still is the number one source of food calories for the Lebanese. In 1961, the per capita supply of wheat represented 46.5% of the caloric intake according to the food balance sheets. A 1963 study of six families in the agricultural Bekaa Valley and a 1965 follow-up study of 24 families in Kfarzubian (25 km northeast of Beirut) found that bread consumption represented respectively 46% and 39% of caloric intake, with cereals and cereal products counting for another 12% in both studies, such that cereals easily represented more than half the caloric intake in each group (Cowan, Chopra and Houry 1964, Cowan 1965).

By comparison, in 2003 wheat represented just 30% of Lebanese caloric intake according to the food balance sheets (FAO Food Balance Sheets 2006). This decrease in volume was accompanied by significant changes in the type and quality of wheat consumed. In 1950, when Lebanon's population was predominantly rural (88% according to FAO statistics), much of the wheat would have been consumed from local production in the form of bread made from hard wheat or bulgur (Cowan et al 1964, Cowan 1965). In 2000, with rural Lebanon making up just 10% of the population, the majority of wheat consumed was imported soft wheat to be made into flat Arabic bread or khubz frengy (leavened "foreign bread"), processed to achieve a lighter texture but thereby losing much of its nutritional value.

Knowledge about the preparation, storage and cooking of traditional, regional and wild foods is one stimulus to people's willingness and ability to consume varied and healthy foods. Traditional food culture is often as rich and diverse as plant varieties, and much of that variety persists in Mediterranean cultures including Lebanon. In Lebanon, the distinctly different urban and rural food cultures may be connected to differing levels of dietary diversity, with increasingly preponderant urban diet being less varied than its rural and traditional counterpart.

Wild plants may have a particularly important role to play in maintaining or increasing dietary diversity, as they are a valuable source of micronutrients (Ogle, Hung and Tuyet 2001, Chadha and Oluoch 2003) Plants such as thyme, coriander (kezubra), chicory (hindbeh) and mallow (khubayzeh) are a vital part of the Mediterranean diet, in which they are consumed and used in various ways (Simopoulos 2001). In Jordan, Tukan described different uses of common edible wild plants such as sumac, chicory, Spanish thistle, wild lettuce, viper's grass, goat's beard, and gundelia (Tukan., Takruri and Al-Eisawi, 1998). Roughly half of these plants can be consumed raw without any preliminary preparation other than cleaning and trimming. Many can also be consumed as snacks, providing important sources of nutrients. Tukan and coauthors also highlighted the numerous ways of consuming such plants in stews, as spices or seasonings, or even in hot drinks.

These practices are often culturally defined and vary according to food habits (Ladio and Lozada 2003). In many cultures such as in the Indian tribe of Paniya or in Ethiopia, the collection of the wild edible plants is most often performed by women and children while men are responsible for activities such as hunting (FAO 1999). .

Studies in different regions of the world have shown that younger people have less knowledge of local edible wild plants than adults (Ladio and Lozada 2003, Adeboye 2007, Grivetti 1978). Loss of expertise in the sustainable use of such natural resources contributes to their extinction, for example with over harvesting of plants or neglect in the preservation of environments in which they thrive (Taïta 2003).

In the Mediterranean region, 4% of wild plants are edible but only 15 to 200 are currently being consumed by humans (FAO 1999). Knowledge regarding the identification, conservation, and use of wild plants is not being actively disseminated, and the rapid urbanization in the region may be responsible for a break in the transmission of indigenous knowledge, which usually occurs through oral tradition and apprenticeship

2.2 Agricultural transformations and agro biodiversity

World population has been on an upward spiral since the beginning of the 20th century, increasing at average annual rate of 1.8 since 1950 (Daily et al, 1998). In response to factors including commercial interests as well as a perceived threat of famine, worldwide efforts focused on making more food calories available and increasing volumes of food produced. The major elements of this agricultural transformation, developed during the Second World War and the 1960s and 70s Green Revolution, include improved seed varieties, increased use of synthetic fertilizers and pesticides, and expansion of surfaces under irrigation and mechanization. The transformation was also characterized by a shift from labour-intensive, low-input subsistence production to input-intensive commercial agriculture.

At the most immediate level, agricultural transformations led to impressive yield increases and lower food costs, reductions of labour shortages and, in some cases, less vulnerability to climatic conditions. Adequacy in world food calorie and protein production was reached

in two decades, in spite of constraints on increasing production through land expansion. Cereal production, which accounts for more than half of the energy intake by the world's poor, increased from 275 kg per person in the early 1950s to 370 kg per person in the early 1980s (Welch and Graham 1999; Daily et al, 1998). However, critics point out that even if total food production per person rose, the number of hungry people was not substantially reduced (Rosset, Collins and Lappé, 2000). While a number of *global* indicators of human well-being such as gross output per head, life expectancy, infant mortality rate and literacy all improved (Daily, 1998), there were setbacks in certain regions, notably sub-Saharan Africa and South Asia (WHO, 2003).

Concerns remain about ability of the food supply to meet predicted future population growth, until at least 2050 when the world population growth rate is expected to level off to 0.5 % from a peak of 2.04% in the 1960s[15]. Moreover, many other aspects of food security remained and are still beyond reach at the global level, including environmentally sustainable food production, local access to food, and nutritional adequacy. There has also been an increasing realization that the problem of hunger is primarily one of distribution and not production. There is little use in having food available when people do not have the means to either purchase or grow it themselves, underlining the importance of poverty reduction, livelihood creation and equitable access to resources including land and water.

To the extent that productivity increases led to decreased food prices, they permit greater consumption of food staples, simultaneously freeing up money for purchases of non-staple foods for those dependent on markets for food. On the other hand, productivity increases can lead to lower incomes for farmers, who make up the majority of the rural poor (Haddad 2000). Finally, for the poor who do not participate in the market as buyers or sellers, changes in market prices are irrelevant.

Given the magnitude of the micronutrient malnutrition discussed above, scientists and policy-makers have begun to question whether agriculture has as important a role to play in addressing micronutrient malnutrition as it has had in alleviating low energy intakes (Pinstrup-Anderson 2000).

The technological changes of the Green Revolution combined with the development of local and national markets, in some cases under the auspices of colonialism, to create a shift away from subsistence agriculture toward markets for both income and food purchases. Assuming that increased commercialization increases household income, in theory it thereby favours household nutritional improvement: more food can be acquired, workloads can be decreased and childcare improved, and sanitation, housing environments, water availability and healthcare can all improve (von Braun 1994).

However, smallholder producers often maintain subsistence food production along with a new commercial production in spite of higher returns from the latter, as a form of insurance against food insecurity. Risky economic environments and inexistent insurance markets make some subsistence farming an economically logical choice for the poor (von Braun 1994). The choice can also be an ecological and healthy one, since home gardens provide important resources for diet and medicine as well as serving as repositories of biodiversity. Thus, while intensive, commercial agriculture may provide economic benefits to rural populations as well as decrease food costs for consumers, it has mixed impacts on nutritional status, to the extent that it can lead to the erosion of local crops and varieties which underpin traditional dietary diversity (Mennen 2000). Production for self-consumption has in some studies been shown to be correlated with higher levels of dietary diversity (FAO 2005b). On the other hand, new-found income can in some cases help people diversify food sources on emerging markets.

While agricultural commercialization takes place in large part on a local or regional level, trade also increasingly occurs across national borders and as part of globalization, by which we mean the growing power of large corporations operating across borders; faster transportation and communication; and the increasing integration of markets and regions under free trade agreements. Following in the steps of studies correlating global trade and increases in tobacco consumption (Bettcher, Yach and Guindone 2000), links are beginning to be made between globalization and the distribution, marketing and consumption of food

[15] Mid-range projections are that global population will grow 40 percent from 5.9 billion (1997-99) to 9.3 billion in 2050 (FAO, 2003b).

within the context of an increasing diet-induced epidemic of chronic disease (Chopra 2002).

Efforts to reduce obesity have so far been primarily either medical (development of drugs to prevent and treat obesity) or focussed on encouraging behavioural changes in diet and exercise, for example through better information and food labelling. Such efforts have generally been unsuccessful (Nestle 2002), suggesting that change is needed at the societal level to reduce not only demand for food also the oversupply (Elinder 2005).

Production increases due to green revolution techniques created major surpluses in the dominant grain-producing countries. The ensuing low world grain prices were accompanied by measures to deal with surpluses and create new markets, including donations or sales at concessional prices to poor countries. In the case of wheat, exports grew 250% between 1950 and 1970 with the portion exported to poor countries rising from 19% in the late 1950s to 66% in the late 1960s. During the same period, wheat consumption in the developing world increased by 62% while consumption of other cereals rose by only 20% and root crop intake fell by 20%. When wheat prices rose dramatically during the 1970s food crisis, many countries were forced to incur debts to pay for wheat imports on which they had become dependant. Much of the developing world began subsidizing production and/or importation of soft wheat or rice, with the objective of preventing hunger and, in many cases, creating national food self-sufficiency. Many countries switched over large portions of land to semi-dwarf cereal varieties, displacing rain-fed crops including coarse grains, oilseeds and pulses (Chopra 2002)

The case of soybean oil provides a clear example of the impact of agricultural subsidies on diet in a globalized world. Production and trade policies in Brazil, which were already focused on promotion of soybean oil production, export and domestic consumption, went further in the 1990s to eliminate foreign investment restrictions, lower import tariffs on pesticides and fertilizers, and remove the soy export tax. The result was a 67% increase in soybean oil production between 1990 and 2001 and a doubling of exports. This massive growth was associated with consumption increases not in Brazil but in China and India, where soybean oil available for consumption increased dramatically, with Brazil as a major supplier. In China, higher consumption of vegetable oil in both cooking and in processed

foods (the latter in hydrogenated form)[16] is such that consumption in urban and some rural areas now exceeds recommended levels and the government has identified it as a cause for concern, given the country's rising rates of obesity and chronic diseases (Hawkes 2006).

A pattern is emerging from a global marketplace being shaped in part by agricultural production and trade policies. While high income groups often benefit from more dynamic globalized markets, for example with the availability of a wide variety of oils including those with reduced transfats, for low income groups the availability of cheap oils is contributing to an increase in poor quality, obesogenic diets (Hawkes 2006). The bottom line is that what is produced is eventually eaten by someone. Overproduction of food by developed countries (causing environmental degradation and slowing growth of the agricultural sector in the developing world) can be linked to obesity and noncommunicable diseases (leading to health care and lost productivity costs). To the extent that these effects are externalities, there is little incentive to reduce them (Elinder 2005).

The environmental and human health impacts of intensive agricultural production are well-documented - including pollution from pesticide residues, water salinization from heavy irrigation, soil degradation from use of synthetic fertilizers and soil erosion due to mechanized tilling. More recent is the realization of the loss of agricultural biodiversity (both plant and animal) and its possible correlation with loss of human dietary diversity. Across the planet, species of plants, animals and insects are disappearing at a rapid rate, along with soil and habitat diversity. For millennia, agriculture has been responsible for much of this loss, partly because it transforms forests and prairies sustaining immense diversity (grasses, trees, flowers, shrubs, insects, birds and other wildlife) into cultivated fields replanted yearly with at best a few crops and varieties.

Green Revolution strategies which contributed directly to loss of agricultural diversity include (based on Thrupp 2000):

> -dominance of a few high-yielding varieties (HYV) of seeds to the exclusion of countless land races

[16] Hydrogenation leads to the creation of *trans* fats, which in turn increase the coronary heart disease risk (Hawkes, 2006)

-increased use of pesticides which eliminate not only the unwanted weeds but also insects, soil organisms, and birds;
-replacement of polyculture with monoculture;
-weak efforts at conservation.

A key aspect of agricultural transformation has been specialization in the production process, reducing the number of crop and/or livestock species that are maintained. While people consume about 7000 species of plants, only 150 of these are commercially important, and just three crops - rice, wheat and maize - account for approximately 60 percent of calories people derive from plants (Thrupp 2000).

Parallel to the reduction in species is loss of varieties. While farmers traditionally saved and replanted seeds which were adapted over centuries to local climate and soil conditions, they now increasingly plant a few high-yield varieties, causing the extinction of innumerable ancient varieties of grains, legumes, vegetables and fruits. To give but one example, in Sri Lanka the number of rice varieties dropped from 2000 in 1959 to fewer than 100 in 1992, with 75% of varieties descending from a common stock (World Conservation Monitoring Centre in Thrupp 2000). Livestock is also experiencing genetic erosion, with many traditional breeds becoming extinct as farmers focus on improved ones. The loss of genetic diversity within plant and animal species poses a threat to the resilience and adaptability of human food supplies, reducing sources of resistance to disease, pests and climatic stress as well as resources for agricultural, pharmaceutical and technological innovations (Matson and Parton 1997; Thrupp 2000; Fowler and Mooney 1990; IDRC 2000).

Diversity is an important method of disease and insect control. The diversity of species has been shown to decrease the incidence of insects, microbes and virus infestations but has a mixed effect on microbial pathogens, while the genetic diversity of crops can significantly reduce pathogen impacts on crop productivity. A review of studies comparing biodiversity levels in organic and conventional farms in the US, Canada, Europe and New Zealand found that in more than two-thirds of studies, organic farming provided greater protection to biodiversity at all levels of the food chain: bacteria, fungi, plants, insects, birds and mammals (Randerson 2004). While the relationship between agricultural and the well-being or degradation of the environment has been studied at length (see for example Lee

and Barrett 2001), the impact of intensification on agricultural and dietary diversity, particularly in the context of developing countries, has so far received little attention (Johns and Eyzaguirre 2005). Recent research revealing important nutrient difference between cultivars points to the importance of considering nutrients as criteria in promotion of varieties[17] as well as enormous potential losses with extinction of varieties (Toledo and Burlingame 2006).

Agriculture in Lebanon is characterized by the prevalence of traditional cropping patterns on small holdings which are increasingly parceled for inheritance purposes[18]. Urbanization is rapidly encroaching on rural areas including fertile land, while substantial areas are unused or abandoned[19]. Although the role of agriculture in the country's economy is declining, it still occupies an important place, generating 6.7% of Lebanon's Gross Domestic Product in 2004 and employing roughly 9% of the labour force in 2003 (MOA 2004, CDR 2002, H. Nasrallah MOA, personal communication, April 2006).

Lebanon's Mediterranean climate allows for a great diversity of production: agro climatic conditions range from sub-tropical to temperate zones with cold winters (MOA 2004). Annual rainfall varies from a high of 1000 mm in the coastal lands and up to 1600 in the mountains, to as little as 200 mm in the Bekaa plains (UNDP/GEF/LARI 2005). Water is still relatively abundant and more than half of useable agricultural land is irrigated (MOA 2004). But the country produces just 20% of its food requirements, importing the balance mainly from neighbouring countries and making it one of the least agriculturally self-sufficient countries in the world (MOA 2005, Gambill 2003).

The main crops are cereals, fruits and vegetables, primarily potatoes, citrus fruit, tomatoes, cucumbers, grapes, wheat, apples, cabbages and olives (FAOSTATS consulted September 8, 2006). Reductions in cereal production in the 1970s and 1980s were compensated for by increases in perennial crops particularly olive production, though at present orchards are

[17] For example, sweet potato cultivars in some Pacific Islands differ in beta-carotene content by a factor or 60, in an area where vitamin A deficiency diseases still prevail (Huang et al 1999 reported in Toledo and Burlingame 2006)

[18] Average parcel size is 0.5 hectares, although farms of more than 50 hectares make up one-third of the usable agricultural land (MOA 2004)

aging and in need of renewal (FAOSTAT data, personal communication H. Nasrallah MOA, April 2006). During Lebanon's 17-year civil war from 1975 to 1992, crop and livestock production was severely disrupted. Major destruction of infrastructure such as roads and irrigation systems as well as large areas planted with land mines further undermined the country's agricultural system.

The high cost of domestic inputs (land, labour and capital) in Lebanon's service-based economy has led to ongoing abandonment of agricultural land, affecting 20% of usable agricultural land and contributing to an aging farm population (MOA 2004). Opaque and obsolete organization of commercial channels and opportunistic behaviour of transformers and merchants makes for a poor and risky environment for farmers, who are thus not encouraged to invest in or modernize their operations (MOA 2004). Although several national and international non-governmental organizations are promoting organic agriculture (and thus biodiversity) through programs to assist farmers in converting from conventional to organic, the market remains small and the sector inexperienced. Lebanon's macroeconomic situation is also not advantageous for agriculture. The country is heavily indebted with debt servicing absorbing roughly half its budget: the debt to GDP ratio is 170% (CIA 2006). Capital from outside the country (principally from the large global Lebanese Diaspora) destabilizes the financial situation, resulting in an overvalued exchange rate which decreases the competitivity of agricultural products on both internal and external markets (MOA 2004).

Lebanon's potential for rich and varied agricultural production is not surprising, situated as it is in both the traditional 'Fertile Crescent' and on the Mediterranean Sea. The Mediterranean region is a centre of global biodiversity, housing twenty five to thirty thousand species, many of which are endemic to the region. Out of the world's 231 most important centres for plant diversity, the Mediterranean region houses eleven and is also one of the centres of crop plant diversity. Lebanon in particular is estimated to contain 2600 floristic species, representing 12% of those present in the Mediterranean region (Heywood 1999).

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[19] 250 000 ha is currently under production, in addition to 100 000 ha of land abandoned due to disinterest and land mines. Another roughly 100 000 ha of rocky or hilly land could be put into production (personal communication, H. Nasrallah MOA, April 2006)

The Levantine Uplands area, consisting of Lebanon, western Syria, parts of Jordan and the northern Palestinian Authority, is one of the few nuclear centers where many important species of temperate agriculture originated, including wheat, barley, lentils and vetch, as well as several fruit trees including almond, pear and pistachio. The wild relatives[20] of many agricultural plant species originating in the Near East are still found in the region and are an important source of disease and pest resistant genes. Land races[21] endemic to the cradle of crop domestication continue to evolve in marginal farming areas, maintaining characteristics of hardiness rather than high productivity (UNDP/GEF/LARI, 2005).

The intensification and expansion of agricultural lands as well as overgrazing by small ruminants and the ensuing degradation of vegetation, soil and water has led to a loss of genetic diversity, such that land races are being lost and wild relatives of crop species are now found only in marginal lands such as field borders and shallow soil (UNDP/GEF/LARI 2005). A recent UN-funded study of three sites in Lebanon[22] found that farmers were cultivating landraces of wheat, barley, chickpeas, grapes, olives and figs, but no local varieties of cherries, apricots, almonds, apples or pears. Local residents described the existence of dense forests of pears, wild plums, hawthorn and juniper in the region a century ago, which have since disappeared almost completely (Barnes, 2005)[23]. Comparison of land cover maps between 1962 and 2000 also suggest decreases in areas on which wild relatives and landraces could be found (Shideed, Mazid, Assi, Amri, Monzer, Bsat and Chamoun, 2005).

An ecosystem assessment in the Lebanese communities targeted for the present research indicated that many of the popular wild edible plants (WEPs) were being depleted and that diversity and density of WEPs was low, except for aquatic species (unpublished research, Wild Edible Plants project, American University of Beirut 2006).

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[20] Wild relatives are relatives of currently cultivated species, genetic resources of potentially critical importance for future plant breeding efforts.

[21] Land races are races of crops and fruit trees which have developed distinctive characteristics in adaptation to the particular environment in which they are currently cultivated.

[22] Including Aarsal, one of the communities participating in our research project

[23] Under Turkish rule in the beginning of the 20th century, people were forced to clear the dense forest for firewood, fuel and railway construction. Now only a few wild tree species are scattered through the bare landscape (Hamadeh et al 2006)

2.3.1 Lebanese Agricultural policy

In Lebanon, agricultural policy is carried out in a highly fragmented, disconnected manner and as a low priority. A wheat and sugar beets subsidy is managed by the Directorate General of Cereals and Sugar Beets at the Ministry of Economy and Trade and a tobacco subsidy program is run by the Régie des Tabacs at the Ministry of Finance. The Ministry of Agriculture is responsible for other crops, agricultural services and cooperatives. It also supervises the Lebanese Agricultural Research Institute and the Green Plan, which helps rehabilitate lands and rural roads neglected or destroyed during the war (MOA 2004; MOA, 2003). An export promotion program is managed by the Para governmental body Investment Development Authority of Lebanon and the Council for Development and Reconstruction manages infrastructure projects, including irrigation, and mobilizes foreign funding.

In 2002, a total of 98.3 billion LBP (Lebanese pounds – equivalent to 65.5 million US$) was spent on agriculture, of which 59.5 billion LBP (39.7 million US $) was spent by the Directorate General of Cereals and Sugar Beets (DGCSB) (MOA 2003). In 2003, only 0.4% of Lebanon's total government budget was allocated to the Ministry of Agriculture: 34 billion LBP (22.7 million US$). Even when all programs benefiting the agriculture sector are combined, the total represents less than one percent of government budgets, very low compared with spending of neighbouring countries[24]. Meanwhile, financing of rural development projects by various international donors (such as the European Union, Japan, several Arab countries and US-based organizations funded by the US Agency for International Development), including significant agricultural development components, totals roughly 50 million US$ per year (MOA 2003).

The investigation of the policy environment for biodiversity and diet uncovered an absence of policy options related to agricultural biodiversity, dietary diversity and wild plants, beyond a few, usually unheeded, conservations laws largely put in place in response to Lebanon's signing of international treaties such as the Convention on Biodiversity. These

[24] For example in the 1980s, Syria was spending approximately 20% of government budgets on agriculture (US Department of the Army Country Studies www.countrystudies.us/Syria/42.htm)

laws have largely been piloted by the Ministry of the Environment, with little or no link made to policies at the Ministry of Agriculture (Akl, Batal and Ireland 2007).

Recent moves to cut subsidies are driven partly by chronic budget deficits and public debt but also by past inefficiencies, excessive red tape and political influence (MOA 2003). The low priority of agricultural spending in Lebanon can also partly be explained by the lack of a strategy for developing the sector; given that a comprehensive strategy was adopted only in 2004. This agricultural development strategy is part of an FAO-supported agricultural survey and was preceded by several background studies as well as consultations with stakeholders in the public and private sector (MOA 2004). Specific agricultural policies are summarized in the following section.

Input subsidies: Numerous irrigation projects are financed by the government and international donors, although costs to farmers are still high relative to other countries. Pesticides are periodically subsidized for strategic crops and in reaction to pest outbreaks – in the past this has included olives and wheat. Certified plants seeds produced by the Lebanese Agricultural Research Institute are sold to farmers at subsidized prices. Although this program is very small, it can nevertheless indirectly reduce biodiversity as only specific crops are targeted.

Agricultural credit: Lebanon is one of the few developing countries in the world without a specialized credit system for the agricultural sector. Loans from banks are mainly short term, relatively expensive and dependant on good management training and collateral, neither of which many farmers possess. Thus less than 1.5% of commercial banks' loans to the private sector go to agricultural activities and those who do receive them are mainly owners of large farms and agro-food industrial facilities (MOA 2003).

Tax exemption: There are tax exemptions on agricultural buildings and land, and 10-year tax exemptions on agricultural industries. Officially, the entire agricultural sector is exempted from taxes, but in fact farmers pay many indirect taxes (such as on fuels, raw materials and inputs, transportation equipment and employee wages if they declare such wages) because they have no legal status and farm units are not registered as economic entities (MOA 2003). This underlines one of the difficulties in developing Lebanon's

agricultural policy: defining who is a farmer. While officially there are 200 000 farmers in the country, a recent study by the Ministry of Agriculture determined that only 30 000 to 40 000 farmers earn enough from their farms to live over the poverty line (MOA 2004). The Ministry of Agriculture plans to focus future policy on these farmers, given that its priority is the development of viable enterprises rather than other potential criteria such as food security.

Subsidized food purchases: Agricultural products are periodically bought for the army at heavily subsidized prices. For example, in 2003, the government spent 10 billion Lebanese Lira (LL) on oil and apples for the army, while the total budget of the Minister of Agriculture and affiliated units that year was 34 billion LL (MOA 2003).

Price supports: A 1959 law supports government subsidization of wheat, barley, corn and sugar beet production. In recent years, only the wheat and sugar subsidy have continued (see details below), in addition to a subsidy for tobacco farmers. Periodically, bakeries have been given subsidized fuel to encourage them to continue supplying bread: this occurred once in 1981 and again in 1991 (personal communication, A. Khoury, May 2005).

Price ceilings: The Ministry of Economy and Trade sets a maximum sale price for two food items – a large 'family size' bag of Arabic bread, and a whole chicken. However, a recent study by a consumer protection association (Association de protection du consommateur, undated) found that 11 out of 12 brands of bread weighed significantly less than the prescribed amount and accounted for a hidden inflation of 8%.

2.3.2 Lebanese trade policy

Lebanon has had a reputation as a nation of traders since the time of the Phoenicians, strategically placed as it is on the Mediterranean Sea between the Far East and Europe. Government policy has historically been focused on the open market and held national food security to be a low priority, in comparison to neighbouring countries such as Egypt and Syria. This policy, combined with the low priority given to agriculture, has resulted in a situation where Lebanon now imports 1.3 billion $ of food a year, compared to a GDP of $12.7 billion (FAO STATS, 2004).

There have been periodic attempts since the 1950s to protect the agricultural sector from certain imports, using a combination of import bans, quotas, licenses and an Agricultural Calendar. This calendar bans imports of fresh fruits and vegetables, processed foods (including olive oil, vinegar, canned tomatoes...) and animal products (milk, yogurt, eggs and poultry) during certain periods of the year. The Agricultural Calendar is revised yearly by the Cabinet upon suggestions of the Minister of Agriculture and Minister of Industry (Khoury 2001).

Customs duties in the past represented Lebanon's main source of public funds, accounting for approximately 50% of government revenues in 2000 and 2001 (MOA 2003). In October 1997, a range of new tariffs and bans on food imports were imposed with the objective of cutting the large trade deficit and increasing revenue; the move also aimed to incite farmers in the Beqaa Valley[25] to abandon their lucrative production of hashish and opium poppies (Gambill 2003). The agriculture minister "drew up plans to ban or tax all the imported food that he believes could be produced locally" (Economist 1997) and certain products were taxed at over 100%. But following pressure from the EU and other trading partners, in 1999 and 2000 the government replaced import bans and administrative regulations except phytosanitary and health measures by import tariffs (MEED 2001). These tariffs were to be reduced from an average of 20% to an average of 15% while rates over 100% were reduced to 70% (Industry Canada 2006).

Duties are applied to most agricultural imports with the important exception of those under trade agreements discussed above, and tariffs range from 0 to 80% with the majority being levied at 5-10%. Agricultural products with a 70% tariff include chicken, yogurt, cheese, honey and various fruits and vegetables: bananas, potatoes, tomatoes and olives (Lebanese Customs Authority 2006). Frequent smuggling and customs reclassification biased by lobbying and bribing occurs (MOA 2003)

In practice, even before many of these tariff reductions were implemented, there was already considerable free movement of agricultural commodities from neighbouring

[25] The Bekaa is a fertile plain in the East of Lebanon, the major agricultural region in the country

countries with low input costs and greater government subsidies[26], notably Syria and Jordan, making it difficult for domestic producers to compete. Syria's military and political control of Lebanon since its troops entered the country in1976 was complemented by an economic occupation including the agricultural sector. After the 1990 when the Syrian presence in Lebanon intensified, Syrian agricultural products flooded the Lebanese markets and tariffs or duties were simply ignored. Meanwhile, Damascus imposed a range of restrictions on Lebanese agricultural produce into Syria. Thus between 1992 and 1997, Syria's agricultural exports to Lebanon totalled 497 million US dollars while Lebanon exported less than $30 million worth of food to Syria (Gambill, 2003).

After the 1997 bans on many agricultural imports, the flood of Syrian goods subsided, apparently as part of Syria's bid to be removed from the United States State Department's list of drug-producing countries. After both Syria and Lebanon were removed from the list, the restrictions were lifted as mentioned above. A bilateral trade agreement signed in 1999 gave free passage to Syrian exports of all but 17 agricultural products and reduction of remaining tariffs by 50% the first year and 10% for following 5 years (Gambill 2003; UNCTAD 2006).

Agricultural calendars and periodic, specific high tariffs aside, Lebanon is taking part in the global movement toward freer trade. Many trade restrictions, including those on agricultural and processed foods, are gradually disappearing. Lebanon has signed several bilateral agreements including ones with Syria, Kuwait and Egypt and the United Arab Emirates, helping a regional Arab market to emerge (UNCTAD 2006, MOA 2003). It has signed on to the Greater Arab Free Trade Agreement under the Arab League, which abolished agricultural tariffs in 2005 and aims to reduce non-tariff barriers to intra-Arab trade (EU 2006), even though there are unofficial exceptions to the zero-tariff rate (personal communication, H. Nasrallah, MOA April 2006). Through the Euro-Mediterranean partnership agreement, an agreement with the EU was ratified in 2003 to gradually phase out tariff and non-tariff barriers in order to ultimately create a Mediterranean free-trade zone (UNCTAD 2006). Finally, Lebanon has observer status at the World Trade

[26] One example is irrigation: a 1997 UN survey reported that Syrian farmers pay an annual flat rate of 26$ per hectare to their government while Lebanese producers pay between 40 and 100$ per hectare. UN FAO, Land and Water Development division, Syrai Country profile, 1997, Lebanon Country Profile 1997, quoted in Gambill 2003.

Organization and is negotiating access; progress was however slowed by the assassination of the former Prime Minister in 2005 and its aftermath (MOA 2003, MOA 2004).

Lebanon provides significant export subsidies through Export Plus, a $33 million program run by the Investment Development Authority of Lebanon with the objective of increasing exports to both new and traditional markets, controlling the quality of agricultural products to ensure compliance with international standards, and transferring knowledge to farmers and exporters. The program contributes up to 100$ per ton to cover the cost of shipping produce overseas. Because subsidies are for transportation and not production costs, Export Plus is WTO-compliant (IDAL 2006). Under the program, exports increased by 15% the first year and 5% the following year (IDAL 2006). Farmers have complained however, that traders and other intermediaries are the main beneficiaries of the program (Gambill 2003).

Adhesion to free trade agreements has put pressure on Lebanon to decrease tariffs and subsidies, limiting possibilities to counteract the effects of its overvalued currency. Lebanon's agricultural trade balance is also increasingly deteriorating as free trade increases without substantial support for improved production (MOA 2004). While a Value Added Tax (VAT) was introduced in 2002 to help compensate for progressive lifting of tariffs, there is little hope for increased agriculture budgets in the current economic situation and high level of public debt. However, the Ministry of Agriculture is proposing the introduction of two measures to increase revenues for agricultural development while only slightly impacting consumers and tax-payers (MOA 2004):

1) a property tax on agricultural land, which would serve to clarify the ownership of land (currently many parcels are under ownership dispute) as well as incite landowners to rent out or sell unused parcels;

2) specific taxes on imported products for which Lebanon is deficient and productivity gains are possible, for example on imports of soft wheat. Such measures are WTO-compliant to the extent that the funds collected are used for national program to develop productivity of the taxed item; in the case of wheat, irrigation of soft wheat could be improved and increased.

A few important crops are highlighted below to provide examples of the impact of agricultural production and trade policy: wheat, sugar beet and oils.

Wheat

Lebanon's fertile Beqaa Valley was once considered to be the Romans' silo, so rich and fertile was its cereal production. Local production is primarily hard wheat, although with increases in irrigation, soft wheat production is also rising: one quarter of cereal area is currently under irrigation (MOA 2005). Per capita wheat production decreased overall from 1966 to 1986, after which it rose to exceed 1960s levels. The overall increase can be attributed partly to increased areas under irrigation as well as improved seed varieties. Although productivity is clearly lower than industrialized countries such as Italy, Lebanon's yield per hectare compares favourably with its closest neighbours Jordan and Syria. Production dips in the late 70s and early 80s coincide roughly with the Lebanese civil war (1975 to 1992).

Increases in wheat productivity have been accompanied by ongoing abandoning of land in cereal production. Eighty percent of agricultural lands abandoned more than 30 years ago were previously planted with grain while roughly 50% of lands abandoned over the past ten years had been producing grain (MOA 2005). The majority of local wheat (65%) is sold through the subsidized system run by the Directorate General of Cereals and Sugar Beet (see below) while the remainder goes to self-consumption, seed reserves, direct sales and home transformation (MOA 2005).

Wheat has been subsidized by the Directorate General of Cereals and Sugar Beets (DGCSB) since 1963. For many years, wheat was bought by the DGCSB and resold to millers, incurring the expense of purchasing at a higher price than they sold as well as storage and transport fees. From 1997 to 2001, the wheat subsidy took the form of obliging flour mills to buy a portion (25%) of local wheat via the government, in order to obtain an import license for wheat from other countries. The mills subsequently obtained the right to import without this restriction as long as they collectively purchase the entire Lebanese wheat production at a fixed sale price. This subsidy therefore does not have a negative

fiscal impact although it raises the price of wheat inputs for millers and potentially the prices for consumers (MOA 2003; personal communication Antoine Khoury, DGCSB).

Wheat is bought from producers at a price higher than global market: in recent years, the price has been approximately 250$ per ton. A maximum of 5 tons per hectare is purchased to minimize possibility of fraud (personal communication, M. Zein al Din and website DGCSB, April 2006). The government then resells the wheat to millers at the global price or slightly less (recently the price has been approximately 150$ per ton). Millers only accept this wheat under pressure, as their flour contains only 5-15% hard wheat, and the quality of local wheat is frequently poor for bread production (personal communication A. Khoury, DGCSB May 2005, MOA 2005). Mills export the surplus hard wheat with major clients being other Arab countries (Liberia, Kuwait, United Arab Emirates...) followed by EU countries (France, UK...) (Lebanese Customs Authority 2006).

While world wheat prices have been low and decreasing over the past ten years, the subsidy paid to wheat farmers has remained at a relatively constant higher level. Sales by farmers under the program have been on the increase, with a substantial jump in 2001 coinciding with the elimination of the sugar beet subsidy[27]: many farmers switched from sugar to wheat production at this time (personal communication, M. Zein al Din, DGCSB April 2006)

Overarching the variability observed in Lebanon's wheat production is the fact that the country is a large net importer of wheat and has been for at least the past 40 years: imports covered 75% of wheat needs in 2002 (MOA 2005). Imports of soft wheat are primarily from (in order of importance) Russia and Eastern Europe, the US, Australia and the UK (Lebanese Customs Authority 2006). The Ministry of Economy and Trade issues import licenses for wheat and its by-products and until recently controlled the amounts imported. Import tariffs on wheat were approximately 5-6% until 1991, when the private sector was allowed to begin importing wheat directly and tariffs were eliminated (personal communication, M. Zein al Din, DGCSB April 2006).

[27] It is not clear whether there is a limit on payments per hectare for the wheat subsidy similar to that imposed on sugar farmers.

For the past four years (2002-2006), the USDA has given wheat donations to international, US-based organizations with offices in Lebanon. The organizations sell the wheat and use proceeds to operate development projects in the country under a 'monetization' program. (Mercy Corps 2002; US Embassy 2006; M. Zein al Din DGCSB, April 2006).

Analysis of the monetization program by Mercy Corps states that "no negative impact on local production is expected to result from the sale of wheat under this program'" given that Lebanon does not produce significant amounts of wheat, that millers buy all local wheat and that substantial wheat imports already occur (Mercy Corps 2004). The program does, however, contribute to the US disposing of excess wheat produced under subsidies, thus pushing world wheat prices down. It also clearly aims to increase market share for its exports, using visibility and contacts from the program to promote "better quality American wheat'"(Mercy Corps 2004). While it is improbable that there is a direct connection between such programs and dietary shifts, an indirect one seems likely, to the extent that prices decrease and consumption increases with subsidization and dumping.

Sugar beet

Sugar beet production and transformation, like wheat production, has been subsidized for the past several decades by the Directorate General of Wheat and Sugar Beets. Up until 2001, payments were made to farmer cooperatives and were directed at both production and refining costs. Because sugar beet production is mainly concentrated in southern and eastern Lebanon, where farmers suffered some of the worst effects of the civil war, ongoing subsidization was justified as a way to help reconstruct the area. Cost of the sugar beet subsidy became substantial as farmers increased production in response to support, reaching close to 20 million US$ per year at the peak in 2000 (Personal communication M. Zein el Din DGCSB, April 2006). The subsidy was abruptly halted in 2001, reinstated at a lower level in 2004 as a support to small farmers, and is scheduled to be phased out in coming years.

Correlation of sugar and sugar beet production and government subsidies indicate that sugar production levels directly mirror the years the subsidy was provided. Unlike the case of wheat where there is a schism between local production type (hard wheat) and demand

(soft wheat), for sugar, a direct link can be seen between production levels and imports: when local production rises, imports decrease as seen between 1992 and 2000. Imports of sugar are subject to a 5% tariff[28], low enough to have seemingly little effect on import levels.

Vegetable oil

In Lebanon, production of olive oil seems adequate in quantity for local consumption ranging from a recently recorded production low of 30,000 metric tons of olives in 1998, to a production high of 190,000 metric tons in 2000 with increased expansion of olive cultivated areas (Haidar 2004). However, problems of distribution and marketing are prevalent and farmers are regularly faced with unmarketable olive oil stocks, driving prices down. Local olive oil is facing strong competition from Turkish, Libyan, and Syrian olive oil imports (Haidar 2004). Consumers seem to also believe that olive oil is unhealthy when cooked which leads them to prefer refined imported vegetable oils for cooking.

The FAO food balance sheets comparing oil production and imports between 1961 (the first year data is available) and 2002 show that while oil production and import quadrupled during this period, olive oil production dropped (Table 6). Nearly half of the massive increase in vegetable oil imports is accounted for by soybean oil, suggesting that the pattern in Lebanon follows the global pattern discussed above. In spite of widely publicized information on the nutritional benefits of olive oil, it is being displaced by less healthy vegetable oils.

[28] There is some confusion on this point as I was informed by the DGCSB (personal communication M. Zein al Din April 2006) that the tariffs have been reduced to zero, but the site for the customs authority lists a 5% customs duty (http://www.customs.gov.lb/customs/tariffs/national/tariff1.asp consulted April 16 2006).

Table 6 : Edible vegetable oil production and imports in Lebanon

	1961		*2002*	
	Production	Import	Production	Import
	1000 Metric tons			
Major vegetable oils				
Soybean oil	0	0	9	30
Groundnut Oil	0	0	4	0
Sunflower seed oil	0	0	5	6
Palm oil	0	0		11
Sesame seed oil	1	0	4	0
Olive oil	10	0	5	0
Maize Germ oil		0		9
All vegetable oils	19	4	26	65

Source: FAOSTATS, last updated March 3, 2006

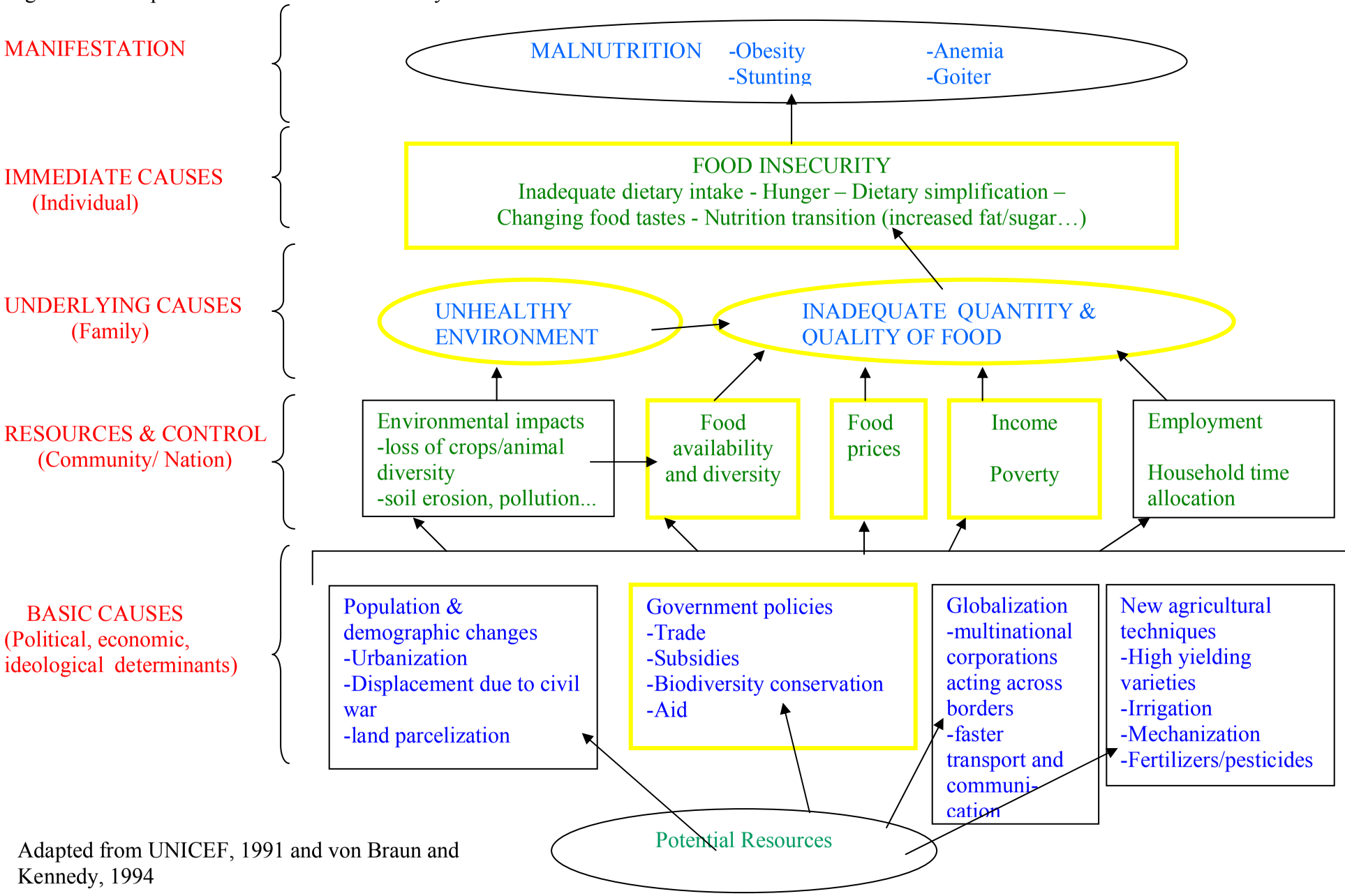
Chapter 3: Approach and Methods

3.1 Conceptual Framework and Research Approach

The diagram below presents the major factors determining and affecting food security, adapted from UNICEF's Conceptual Framework of Malnutrition as well as von Braun and Kennedy's analysis of agricultural commercialization. The framework recognizes political, ideological and economic factors as basic causes contributing to human health and nutrition. It emphasizes the impact of such factors not only on income, employment and food prices but also on the environment, which in turn can create the conditions for food insecurity, manifesting itself in malnutrition.

While the relevancy of all elements of the diagram is recognized and touched upon in the thesis, the factors outlined in yellow are the focus of the present study. For example, while loss of agricultural biodiversity is discussed as a critical influence on loss of dietary diversity, the field research did not attempt to measure such loss in the participating communities. Also, while malnutrition (both under nutrition and obesity) is the human health problem being addressed, detailed analysis of the nutritional situation in the communities is reported elsewhere. Disease, which is an immediate cause of malnutrition and is included in the original UNICEF framework, has been excluded as it is not a focus of this study.

Figure 2: Conceptual framework: food insecurity and malnutrition



Adapted from UNICEF, 1991 and von Braun and Kennedy, 1994

Recognition of the multidimensional nature of human health is central to the Escheat approach used in this study which considers humans to be at the core of development while attempting to ensure the sustainability of the ecosystem of which we are an integral part. Methodologically, the EcoHealth approach also advocates a trandisciplinary orientation with research conducted with community and stakeholder participation, in a gender-sensitive and equity-oriented way (White 2006, IDRC 2006):

-*transdisciplinarity* refers to "the integrated form of carrying out research by teams of scientists from various complementary disciplines in dialogue with local knowledge systems and experts";

-*participation from community representatives and stakeholders* is a process "whereby the research beneficiaries influence and actively participate in making decisions related to the research and ensuing development initiatives";

-*gender and social equity* are addressed in the research agenda to allow for "a better understanding of local knowledge systems and of differences that characterize the way in which men and women cooperate, divide responsibilities and resources, and control them" (all citations from IDRC 2006).

3.2 Survey Methodology

As part of the Wild Edible Plant project, a survey was carried out in six rural communities, with three smaller villages, situated in close proximity, grouped together for analysis. Communities were selected by the American University of Beirut Wild Plant project with the objective of including populations which were both rural and poor, in areas of the country where it was known that wild plant collection was practiced. There was also an interest in including populations of varying confessional background; thus Aarsal is predominantly Sunni Muslim, Hermel (and the neighbouring village Kuakh) are Shiite Muslim, and the Chouf villages are a mixture of Druze and Christian.

Surveys were conducted during the period from June to August 2005. A random list of households was drawn in each community from municipal tax files. To reduce variations due to age and because the project was interested in food traditions still strong in older rural

residents, one man and one woman between the ages of 40 and 60 years were approached for interviewing where possible. If more than one person met the age criterion, the person interviewed was the one considered to be the male or female head of the household: in practice many individuals from one-person households were also interviewed. 798 interviews were conducted. A draft questionnaire was written and piloted. Unclear questions were modified and the length was cut; the final survey took an average of 60 minutes to administer. Originally written in English, the questionnaire was translated to Arabic and back-translated after the final version was established. See questionnaire, Annex 1.

Interviewers residing close to each community were recruited and trained in dietary assessment techniques, survey administration as well as being taught how to take necessary anthropometric measures (height, weight, blood pressure). Ethical approval was obtained from the American University of Beirut Institutional Review Board.

The 24 hour recalls were conducted using visual references in an attempt to define and quantify food intake during a specific day just before the interview. A sub sample of 295 households was recontacted during the following winter season, both to take a second 24-hour recall and for an additional questionnaire asking about agricultural production (see questionnaire, Annex 2). This short survey consisted of questions which were conceived after the main survey had already begun but added insights into agricultural production in the communities.

Completed questionnaires were entered in SPSS (version 14) and used for both descriptive results and regression analysis, complimented by Excel analysis of secondary surveys (market and agricultural). Calculation of food baskets nutrients and items was done using Nutritionist Pro and Excel. Binary and multinomial logistic regressions were run with food security as the outcome variable of primary interest.

The fact that the research for this thesis was integrated into a larger research project was invaluable in terms of the additional contacts, support and resources available and allowed access to a much larger survey than would otherwise have been possible. I was fortunate to be able to include numerous questions in the survey from the initial stage and have input

into important elements of the survey methodology. I coordinated the market survey and determined, with the agreement of other researchers, the items to include in the normal and healthy baskets, created the agricultural questionnaire and the in-depth questionnaire for farmer interviews as well as the focus group questions on food sources. Other elements such as data entry, coding and preliminary analysis of data from the larger data set were carried out by other members of the team and not always within my control, resulting in some difficulties. One example of this is the agricultural survey, which was carried out by interviewers trained by nutritionists unfamiliar with agriculture and therefore unable to adequately probe producers to elicit data (such as for volumes produced or inputs used) which could be standardized for comparison with others.

Food Security Methodology

There are generally three methods used to identify household food security (Kabbani and Weheli 2004):

1. *Nutritional assessments* of household members (height-weight indices, dietary intake, blood tests for nutritional deficiencies). Recent studies have proposed using dietary diversity as a simpler and easier-to-use proxy for such nutritional assessments - see discussion of dietary diversity below;
2. *Measures of income and food expenditures* identifying whether households earn and spend enough on food. This can include calculation of the cost of a food basket (see below);
3. *'Direct' or 'experiential' measures* of food security in which individuals are asked general questions about their (or more commonly, their household's) experience in accessing an acceptable quantity and quality of food.

The measures are not by any means equivalent and each highlights different aspects of household need and deprivation. Experiential measures of food security are of interest because they are easier and cheaper to apply than the measures of nutritional adequacy which require complex quantitative information and tests. (Ruel 2003; Kabbani and Wehelie 2004; Hodinnott and Yohannes 2002).

3.2.1 Direct/Experiential Food Security Measures

Measures of experiential food security around the world have been influenced by the successful development and implementation of a 'direct' food security measure during the

1990s in the United States. Similar measures are being tested in several developing countries, including Bangladesh, Uganda, India and Yemen (Kabbani and Wehelie, 2004). While countries, regions or organizations may have different definitions of food security and hunger and therefore different survey questions, it has been shown that if 3-4 questions are common and judged to mean the same thing or measure equivalent levels of severity allows results of different questionnaires to be comparable (Nord, Satpathy, Raj, Web and Houser 2002).

The United States Department of Agriculture (USDA) Household Food Security studies classify households into food secure, food insecure without hunger and food insecure with hunger, though in practice the lines are somewhat arbitrary in a gradation from those who never experience hunger to those who experience it frequently. (Nord et al 2003). A set of questions about behaviours and experiences characterizing households facing difficulty in meeting their food needs is asked, including perceptions that food is insufficient, inadequate, unacceptable, uncertain or unsustainable (Wolfe and Frongillo 2001). Hunger has been defined as "an uneasy and painful sensation caused by lack of food; the recurrent and involuntary lack of access to food. Hunger may produce malnutrition over time… Hunger is a potential, although not necessary, consequence of food insecurity" (Expert group of the American Institute of Nutrition, published in 1990 by the Federation of American Societies for Experimental Biology. Cited in Bickel et al 2000).

Less severe food insecurity involves qualitative compromises in food selection, consumption and possibly anxiety about upcoming meals. The middle stage entails quantitative compromises in food intake and physical sensations of hunger while the most severe stage comprises absolute food deprivation: not eating. This gradation highlights the overlapping aspects of quantitative and qualitative food insecurity. Quantitative food insecurity is likely to be less common in high and middle-income countries than qualitative food insecurity. Chronic compromises in dietary quality are likely to be more prevalent and may have more serious implications for health over long-term than periodic episodes of absolute deprivation. (Tarasuk 2001).

Results from the US food security surveys are used to try to assess the effects of participating in food assistance programs. However, difficulties arise because selection

into the programs is an endogenous decision: greater levels of food insecurity leads to greater likelihood of participation in the programs, a positive relationship which needs to be controlled for in order to evaluate the degree to which participation reduced food insecurity and hunger (Kabbani and Wehelie 2004).

Based on the US and other experiences with food security surveys, ten food security questions were included in the survey (see attached survey). Several questions took the exact wording of the US surveys (translated into Arabic), permitting comparison with results from other countries also using these questions. A binary variable was created for food security by combining cases where people had answered positively to at least one of the clear quantitative food security questions (FS1, sentence 1 or 2, FS2, FS4, FS5, FS9 in questionnaire).

Much of the food security analysis uses only the women's responses so that responses in two-respondent households would not bear undue weight, and under the assumption that women are generally more knowledgeable about issues relating to household food consumption.

3.2.2 Dietary diversity measures

Dietary diversity is commonly measured by counting the number of different foods or food groups consumed over a certain reference period. Food intake is generally discovered by

-noting weighted intake of foods within a given period
- 24-hour recall, in which participants list all food consumed over the past 24 hours, or
-a food frequency questionnaire, which lists foods and ask respondents the frequency with which they consume each item.

While the weighted intake method provides relatively exact information, it can only be used with small samples of literate and highly motivated individuals. The 24-hour recall is generally done with interviewers using sample cups and spoons to help respondents quantify their answers and is also relatively time consuming. The food frequency questionnaire method has the advantage of being easily administered to a large sample. Limitations include the absence of quantitative information about portion size consumed

and errors due to false perceptions of the frequency of consumption of each food. In addition, food frequency questionnaire responses may emphasize recently consumed foods (Fowke, Schlundt, Gong, Jin, Shu, Wen, Liu, Gao and Zheng 2004)

Following the recommendations found in Clausen et al (Clausen, Charlton, Gobotswang and Holmboe-Ottensen 2005), it was decided to use an unquantified food frequency questionnaire.

Some studies have shown food groups to be more highly significant than food counts (Ruel 2003). The way that the categories are constructed has an important impact on outcomes. For example, animal products could be considered one group or separated into meat, dairy, fish and eggs. Ruel notes that it is important for each research context to define the set of foods and food groups that can contribute to improving dietary quality. It is also important to adopt a scoring system using food groups which are adjusted to the research context. Scoring can also include consideration of the number of portions of different food groups in keeping with dietary guidelines if the study aims to reflect dietary quality as well as diversity.

Although overall nutrient intake often improves with increased food variety, increased consumption of fats, sugars, salt and refined foods often takes precedence over other foods. Ensuring nutrient adequacy may involve increasing both food item and food group variety, as well as maintaining a focus on overall nutritional guidelines rather than exclusively promoting dietary diversity.

Food item score

The food item score, which gives us a score of total number of different foods consumed by each individual, is based on the food frequency questionnaire. This was converted to useable numbers by reducing all answers to daily equivalents, following Hu, Rimm, Smith-Warner, Feskanich, Stampfer, Ascheirio, Sampson and Willett 1999. For example, if someone says they eat tomatoes every day, they have a score of "1"for tomatoes. If they said they eat red meat twice a week, they get a score of 2/7 (.285) for red meat. We calculated the food item score for foods consumed more than once per week by counting the number of foods which receive a score of more than 1/7 = 0.1428.

This method is relatively original, though elements of it were found in Hu et al and Clausen et al. It was devised in order to be able to obtain one number representing frequency of food consumption for each item from the FFQ information, in order to make calculations for diversity and construction of food baskets. Studies which used quantitative intake methods (24-hour or FFQ) may set a minimum quantity consumed in order to be counted in the diversity score (see for example Torheim, Barikmo, Parr, Hatloy, Ouattara and Oshaug 2003). Other studies using 3-day food intake recall or records count any food consumed on at least one occasion during the three days (see Bernstein, Tucker, Ryan, O'Neil, Clements, Nelson, Evands and Fiatarone Singh 2002). Finally, several studies use weighting methods. The method devised in our study is more exact that that used in studies which set weights according to frequency of consumption but with an approximate relationship to the reported intake frequency[29] (see Clausen et al 2005 and FAO 2005b).

Food group score

We created a second score based on food groups by choosing 8 food groups which received scores (groups in bold, Table 7). A person who ate something from one of those categories once per week or more frequently received a score of 1, someone who ate from 5 categories received a score of 5 and so on. Foods which do not enter in any of the categories (drinks other than milk or fruit juices, sweets and desserts, chips etc) received a score of zero.

Table 7 : Foods used for food group scoring

Food Category	*Question # (DIE3, FFQ)*
Meats	**7.1-7.7**
Starches	**1.1-1.7**
Fats and oils	**8.1-8.5**
Legumes	**5.1-5.5**
Dairy products	**6.1-6.9**
Fruits and fruit juices and wild fruits	**2.1-2.17, 9.1, 12.1-12.10**
Vegetables	**3.1-4**
Sweets and desserts	**10.1,10.2,10.4**
Unhealthy snacks	**10.3**
Wild edible plants	**11.1-11.9**
Caloric drinks	**9.2,9.3,9.7**

[29] For example, Clausen et al set weights as follows: 7:every day; 4: 3-6 times per week; 1: once or twice per week; 0: less than once a week.

Non caloric Drinks	**9.4-9.6 except 9.1**

3.3.3 Self-production and self-gathered food measures

Separate questions were asked about the production of food (plant and animal) and the gathering of wild edible plants. The food frequency questionnaire also asked, for each food item, whether people buy it from a store, directly from a producer or produce it themselves.

3.3.4 Control variables

Several control variables were selected, using a combination of economic theory and common sense, and tested:

- Income: Using the categories from the first income question (INC1).
- Wealth: Because income indicators are more sensitive to short-term fluctuations (shocks) than the ownership of durable goods, a wealth measure was calculated using a proxy for wealth based on a list of 23 assets (see questionnaire, question INC17). A household asset score was derived by assigning each item on the list a weight equal to the reciprocal of the proportion of the study households that owned one or more of that item, multiplying that weight by the number of units of the asset owned by the household, and summing the product over all possible assets (following Morris et al IFPRI, 1999).
- Crowing index: Number of rooms (excluding kitchen and bathrooms) divided by total number of people living in house (GEN 13 and GEN11)[30].
- Number of household members (GEN11).
- Number of children under 15 in the household (GEN12).
- Ratio of dependant children: Because data was not collected on the number of people over 65, we were only able to create a variable estimating the number of dependant children to the total number of people living in the household.
- Employment status: An employed/not dummy was created using the categories of 'present occupation' (GEN 7). Those who classified themselves as farmers, employees (blue or white collar) or self employed were considered to be employed and the remaining categories (unemployed – looking for a job or not; homemaker, student and retired were considered to be unemployed) [31].

[30] In Lebanon, it has been found that the type of dwelling and its ownership is not correlated with living conditions as an important portion of deprived households own their houses. However, a clear link was found between the number of rooms and area of the dwelling and the degree of satisfaction. The average number of persons/room Hermel is 1.79 against the Lebanese average of 1.26 (MOSA/UNDP 1998).

[31] Following international standards on the definition of employed vs unemployed, we have used the smallest reported unit of hours worked: see Resolution concerning statistics of the economically active population,employment, unemployment and underemployment, adopted by the Thirteenth International Conference of Labour Statisticians (October 1982)

- Education: Four categories of education were made using question GEN7 : illiterate, low education (reads and writes/ primary school), medium education (intermediate/secondary school), high education (technical/vocational/university). Three dummy variables were created and the 'illiterate' category was omitted.

3.3 Food Costing Methodology

Nutritious Food Baskets are costing tools which are carried out and used by local, provincial /state and national governments. In Canada, the Montreal Diet Dispensary has been costing food baskets since 1948. In the United States, four food plans are made up (Thrifty, Low-Cost, Moderate-Cost and Liberal) by the US Department of Agriculture, reflecting the food expenditures of the four quartiles of the US population. Using mathematical optimization models, deviations from average consumption patterns are minimized, resulting in new consumption plans that meet dietary standards while maintaining constant cost levels (Carlson et al 2003). These new food plans can then be used to provide benchmark costs for feeding different age and gender groups: for example, food costing by the Canadian government results in costs for 23 different age and gender groups from toddlers to the elderly (Government of Alberta 2005).

Food Basket pricing are used by governments to establish levels for programs such as welfare and food stamps; by bankruptcy courts to determine food expense and by divorce courts to establish alimony payments. Costing is based on the assumption that meals are all eaten at home, in the case of both Canadian and US basket, and baskets are primarily made up of ingredients rather than ready-to-eat or processed foods, in the case of the US baskets (Carlson et al 2003). In should be kept in mind that such assumptions reduce the cost of the basket but represent a deviation from the common practice: in the US nearly half of food expenditures are made away from home (Family Economics and Nutrition Review 1999); in developing countries such as Benin, 30% of meals are eaten outside the home (Van Liere, Ateglio, Hartog and Den Hautvast 1995).

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http://www.ilo.org/public/english/bureau/stat/res/ecacpop.htm We chose to use a binary variable rather than number of hours worked per week because of the problem of endogeneity: hours worked is likely to be directly correlated to income.

For our study, a food basket analysis was conducted with the objective of evaluating whether people in these communities have physical and economic access to healthy and diverse diets. Prices and availability of food sold on the retail market in each of the rural communities was evaluated and the cost of both a normally-consumed basket of food and a nutritious food basket was calculated using the following steps:

Step 1: Focus Group Interviews

Interviews were conducted with one focus group from each rural community with the objective of better understanding where people obtain their food: types of stores in the community as well as which foods tend to be self-produced, bartered or purchased directly from the producer.

Step 2: Data collection on prices

Prices and availability were checked in a total of 43 stores (butchers, bakeries, variety stores, supermarkets etc) during the period between June 15 and July 15, 2005: 16 in Hermel and Kuakh, 17 in Aarsal and 10 in the Kfar Nabrakh/Batloun/Warhaniyeh cluster. Stores were selected in different areas of each community in a random manner. In Aarsal, where there are large numbers of butchers and variety stores scattered throughout the town, it was decided to choose three areas of town, and in each area to survey 2 smenes (variety stores), 1 butcher, and 1 chicken restaurant, in addition to the specialized stores (bakery, supermarket, fruit/vegetable stores). In Hermel/Kuakh and the Kfar Nabrakh/Batloun/Warhaniyeh cluster, stores were selected by interviewing one on a street, skipping two, interviewing one and so on, such that the entire village/area was represented while also getting a sample of all types of stores.

A list of supermarkets in Lebanon with greater than 200 square metres surface area was also obtained from the Ministry of Economy and Trade; no such stores exist in our rural communities. Although people do on occasion go to larger cities to access the variety and low prices of large supermarkets, we did not include them in the survey.

Step 3: Food basket construction

The market survey was based on the construction of two food baskets, a Normal Basket representing usual consumption of the population surveyed, and a Healthy Basket.

The Normal Basket was made up of the top 50 most-consumed foods, based mainly on the results of a quantitative food frequency questionnaire (FFQ), with some use of results from the 24-hour recall. Results from the FFQ were converted to a score for each item by multiplying the percentage of respondents who ate from each of four categories of frequency by a weight congruent with the frequency:

-the percentage of those who ate the item once per day of more often was multiplied by one
-the percentage of those who ate the item 4-6 times per week was multiplied by 0.71 (5 divided by 7)
-the percentage of those who ate the item 1-3 times per week was multiplied by 0.28 (2 divided by 7)
-the percentage of those who ate the item 1-3 times per month was multiplied by 0.07 (2 divided by 30)
-the percentage of those who ate the item less frequently than once per month was ignored.

This weighting system was inspired by methods reported in the Barbados Food Consumption and Anthropometric Surveys 2000 (FAO 2005b) and Hu et al 1999.

The 50 items with the highest daily equivalents were included in the Normal Basket. The choice to use 50 items was made based on basket methodologies in other countries (see for example the Government of Alberta Nutritious Food Basket); it is clear that 50 items covers the great majority of the food ration in these communities, as the mean dietary diversity item count was 43 (see results below).

Next, a Healthy Basket was constructed by substituting items considered to be unhealthy (i.e. items high in saturated fats, sugar and salt and low in fibre) with other items, and cutting down on items considered to be grey areas in terms of health such as coffee and tea.

We attempted to minimize the changes in the pattern of food consumption, replacing for example full-fat labneh (strained yogurt) with low-fat and sugar-sweetened juice with 100% natural juice. While maintaining portions sizes, the following changes were made:

- Sugar was reduced in quantity from 2.88 servings to 1 serving per day
- Coffee was reduced in quantity from 1.52 servings to 0.5 serving per day
- Tea was reduced in quantity from 1.36 servings to 0.5 serving per day
- Whole milk was increased in quantity from 0.3 servings to 1 serving per day
- Full fat labneh was substituted by low fat labneh
- White Arabic bread was substituted by whole wheat Arabic bread (though some whole wheat bread was already in the normal diet)
- Vegetable oil (corn) was substituted by olive oil (though some olive oil was already in the normal diet)
- Mixed nuts was substituted by unsalted peanuts
- White rice was substituted by burghul
- Soda was substituted by fresh juice (though some orange juice was already in the normal diet)
- Chocolate was substituted by dried apricots (the most common dried fruit)
- Processed yellow cheese was substituted by white unprocessed cheese.

A list was constructed to contain all items in the two baskets (see Table 32 in results section for item list) and prices were checked for a predetermined size which was judged to be most frequently consumed. If the item was not available in that size, the nearest equivalent size and price were noted. In all cases, the cheapest available price was noted.

Next, items in the food baskets were quantified based on a sample of 100 responses to the 24-hour recall section of our survey. Thus if someone eats bread twice a day, we multiplied the average portion size by two and then converted it to a weekly amount by multiplying by 7. Because quantities reported for men and women were similar for most items, and in the interest of simplicity, it was decided to make a genderless 'adult' basket based on the average amounts of male and female consumption.

Finally, the cost of the food basket was calculated using prices obtained in the market survey. Prices were calculated based on the average of all stores surveyed in each of the three regions, such that a comparison can be made between regions, but without any attempt at weighting according to criteria such as size of store or frequency of use. The final basket cost presented is based on an average of the costs in the three regions.

3.4 Policy Analysis Methodology

Our contention is that the dietary changes occurring in Lebanon, and their attendant health impacts, are not simply the effect of personal choices but are also influenced by

government policy. The intent of this aspect of the thesis is to identify agricultural production and trade policies which have influenced dietary changes in Lebanon, and to suggest ways in which they could be modified to have a more positive effect on health. The methodology for this analysis includes:

- a literature review of agricultural and trade policy in Lebanon -interviews with key informants, particularly government officials
-analysis of FAO Stat data and government data regarding agricultural production and trade in Lebanon

Much of this review and analysis has been included in the general literature review above, while the remainder has been used in the discussion and conclusion to contextualize analysis from the study and broaden its implications.

Chapter 4: Results and discussion

Survey Results

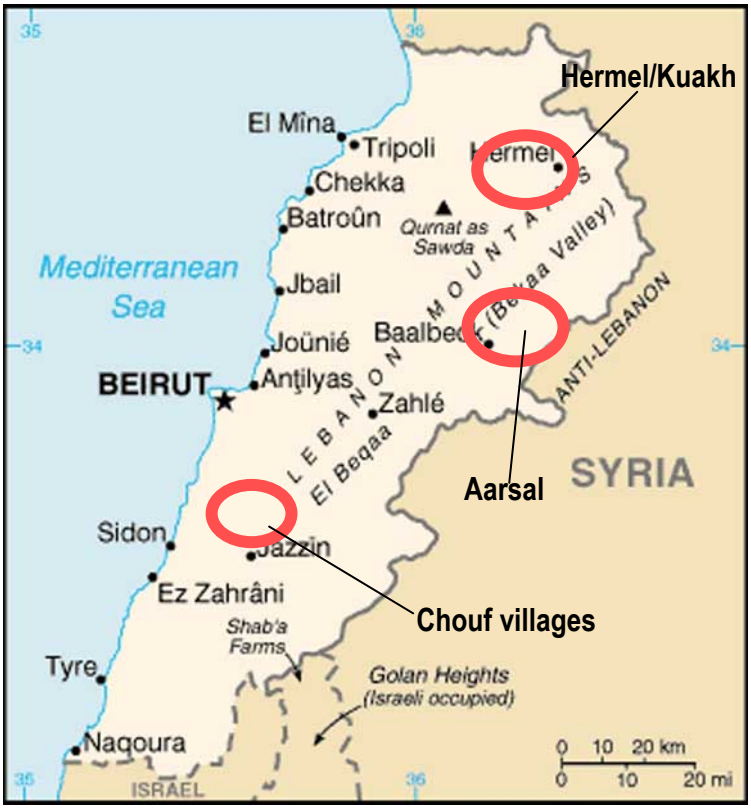
Participation in surveys was high, and the proportion of contacted households that did not participate because of refusal or lack of members who met the age criterion did not exceed 20%. Women comprised 48% of the participants and men 52%.

4.1 Descriptive results

4.1.1 Communities

Communities were selected by the American University of Beirut Wild Plant project with the objective of including populations which were both rural and poor, in areas of the country where it was known that wild plant collection was practiced. There was also an interest in including populations of varying confessional background; thus Aarsal is predominantly Sunni Muslim, Hermel and Kuakh are Shiite Muslim, and the Chouf villages are a mixture of Druze and Christian.

Figure 3 : Map of participating communities



Community Descriptions

Community descriptions are based primarily on interviews with mayors of the villages conducted by members of the AUB research team, and results from our survey. Following this is a description of agricultural production in all communities, based on selected questions in the main survey and a more extensive survey given to a sub sample of individuals.

Aarsal

Aarsal is located in the Bekaa, 35 kilometres away from Baalbeck, 14 km away from the Syrian border and 122 km away from the capital Beirut. Its altitude is 1400-2000 m above sea level.

Covering 36000 hectares (360 km²) of land area, Aarsal is divided into a vast eastern arid region, the valleys of which surround the town, and a mountainous region (Al Jurd). The

climate is humid in the north and dry desert in the south. It is mainly covered by yellow calciferous soil suitable for dry farming and pasture. The rest of the land is red and grey soil. Surface water is present as well as a river which flows seasonally.

Aarsal has a population of roughly 35,000 of which 24,500 are permanent residents. Their major source of income is from stone quarrying, agriculture, and rearing goats and sheep. Wheat, chickpeas, and barley are cultivated for local consumption, though much less than a century ago when thousands of hectares of cereals and pulses were grown. Fruit trees, especially cherries and apricots, are a major production since the 1950s; the 2 million trees represent a major source of income to 60% of villagers. Since the introduction of the fruit trees, there has been a conflict between such production and the stone quarries which degrade the environment; and pasture that is being grazed by animals, exacerbating the existing desertification (Hamadeh, Haidar and Zurayk, 2006).

Hawthorne, sumac and grapes are also present as well as wild pear trees and wild almond trees. Cultivated vegetables include eggplants, tomatoes, and cucumbers. Most production is used locally with some vegetables marketed in Zahle. The dairy and meat produced from some 60 000 sheep and goat are used for consumption in the local area, the Bekaa, and by industries in nearby Chtaura.

Electricity and telephone services are provided though there are no sewage disposal networks. Water for household consumption is from artesian wells and stored in water tanks. There are 5 public schools and 7 private schools, 1 vocational institute and a health and social center run by the Ministry of Social Affairs. Local health care is provided by 5 dispensaries and doctors of various specialties.

According to our surveys in Aarsal, (n= 282), the mean household income in Aarsal was 872 051 LL per month (roughly 872 Canadian $ - standard deviation 509 918). The mean number of people living in the household was 6.4 (sd 2.3) and while respondents had an average of 5.72 children (sd 3), the mean number of children under 15 living in the household was only 2.1 (sd 2), reflecting the age of respondents (40-60).

Figure 4 : Income histogram – Aarsal

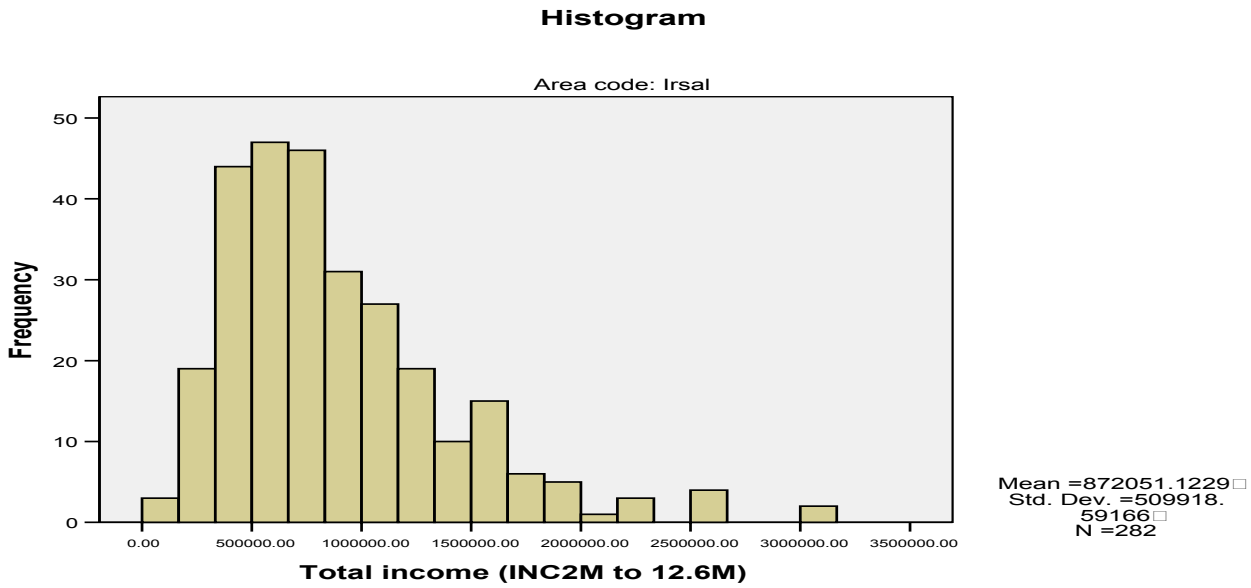


Figure 5 : Present occupation - Aarsal

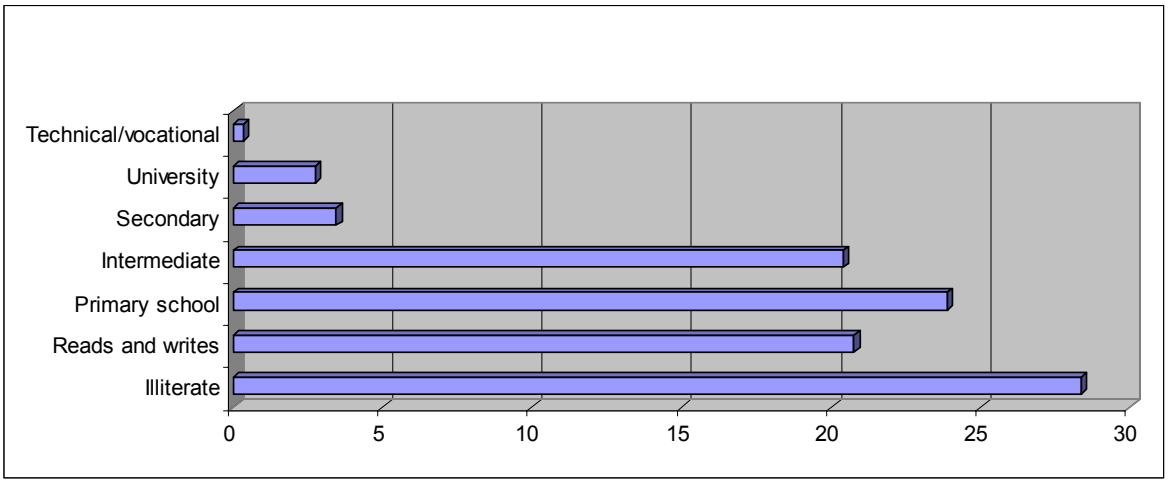
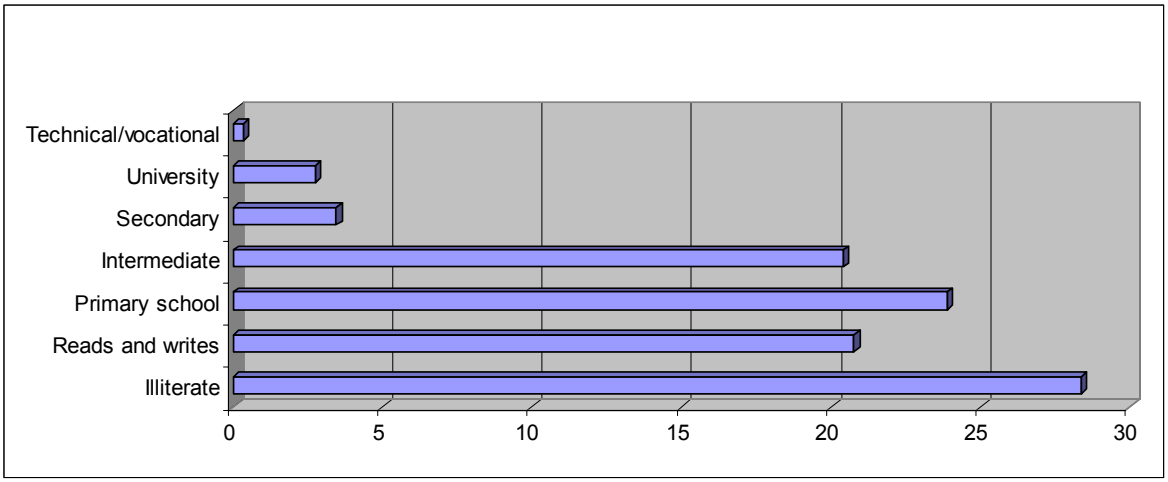


Figure 6 : Education level - Aarsal



Hermel

Hermel is located in the Bekaa, 16 km away from the Syrian border, 750m above sea level. The town owns 300 hectares (3 km²) of land and has an official population of 100,000, only half of which resides in the town.

The climate is semiarid and the soil red rose. The most widespread agricultural production is watermelon, green peas, beans, potato, and eggplant which are distributed in Lebanon for consumption. The fruit trees cultivated in this village are olive, apricot, green plum, pomegranate, figs, loquat, and grapes vines. A major portion of the land is used as forage pastures in Hermel. Sheep, cows, and goats are herded to graze from the land. The goods produced are used within the local community and a few are marketed in Beirut.

There are some 15 touristic and historical locations that provide a source of income to the families. The industrial sector in the village is almost inexistent with only a small milk factory that supplies the village.

Infrastructure is of poor quality. Electricity is provided but use is very restricted in some neighbourhoods. However, the telephone system is good and is provided to the whole town. There is no sewage disposal system. Drinking water is supplied from a spring and distributed to homes. Water for household consumption is provided from artesian wells.

Hermel is adjacent to the Assi, one of two major rivers in Lebanon. Water consumption from this river is however limited due to trans-boundary issues with Syria. There are 8 elementary schools (3 public and 5 private), one intermediate school and 2 secondary schools, in addition to 2 vocational institutes.

According to our key informants, the most occurring health problems in Hermel are hypertension, cardiovascular diseases, and diabetes. There are numerous doctors' clinics, five dispensaries and two hospitals (1 private, 1 public). According to our surveys (n=255), the mean household income in Hermel was 931 673 LL per month (roughly 931 Canadian $ - standard deviation 581 195). The mean number of people living in the household was 5.8 (sd 2.2) and while respondents had an average of 5.1 children (sd 2.5), the mean number of children under 15 living in the household was only 1.4 (sd 1.4).

Figure 7: Income histogram - Hermel

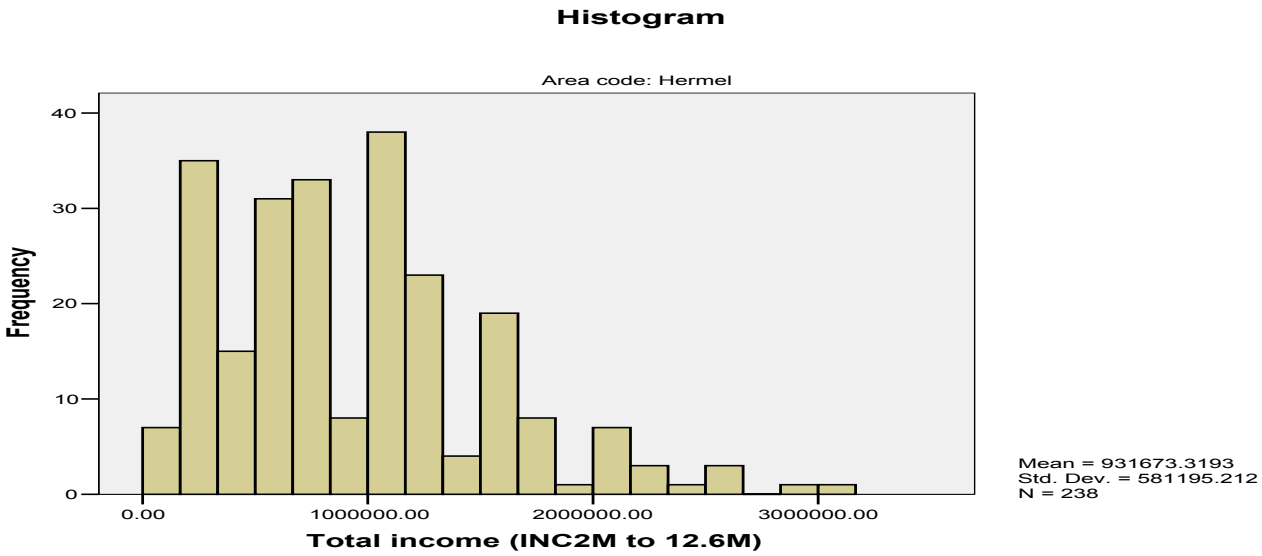


Figure 8: Present occupation – Hermel

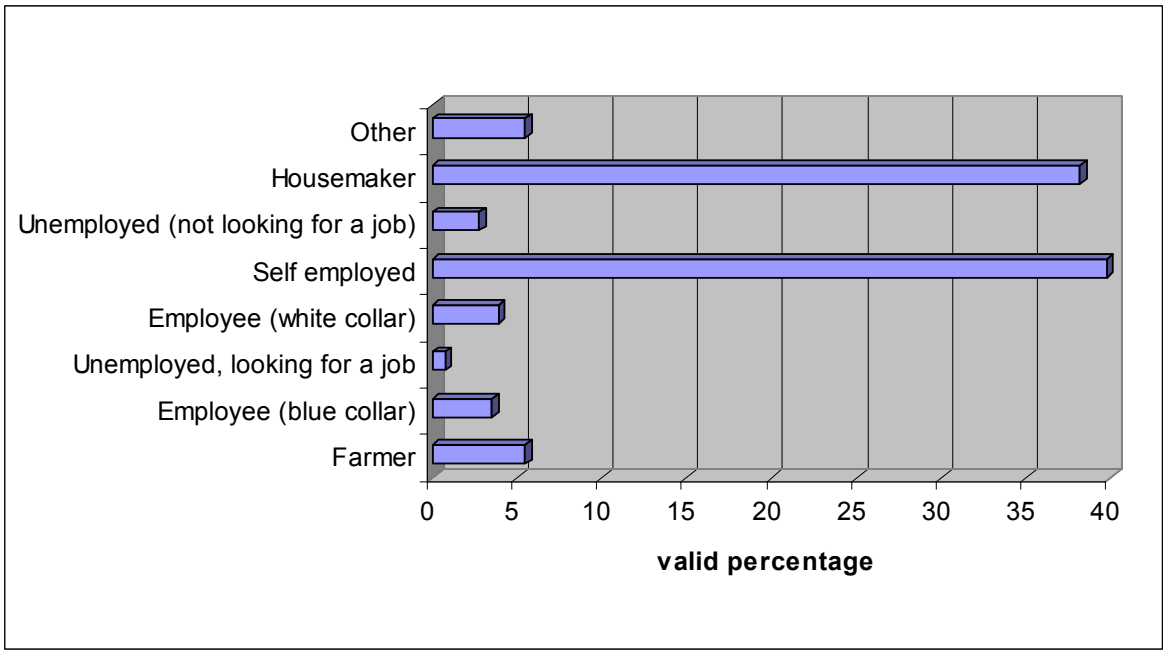
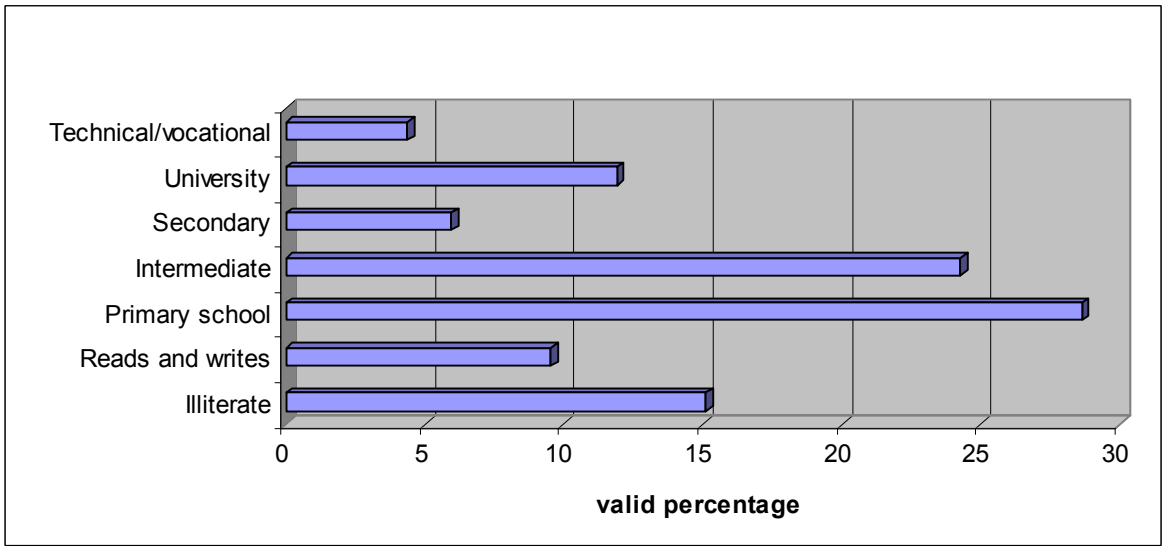


Figure 9: Educational level - Hermel



Kuakh

Kuakh is located in the Bekaa, 8 kilometres away from Hermel, 12 km away from the Syrian border and 151 km away from Beirut. Its altitude is 650 m above sea level. With a land area of 10 hectares (0.1 km²), the population is 3000 but just 20% remain as residents in this remote village.

The climate in Kuakh is semiarid. Its predominantly red soil generally has low nutrient status and supports only some agricultural use. The most widespread agricultural production is wheat which is used for local consumption and cattle feeding. The fruit trees cultivated in this village are olive and almond. A major portion of the land is used as forage pastures. Most of the families depend on raising livestock for a living and herd sheep, cows, and goats..

Infrastructure is poor. Electricity is provided but use is very restricted and there is no landline telephone system although the cell phone network reaches the village. There is no sewage disposal system; only septic tanks are used. Drinking and consumption waters is provided from artesian wells and distributed to the houses. The water distribution system, dysfunctional since the beginning of the civil war, was restarted two years ago. There is one primary school in the village.

According to key informants, the most frequent health problems in Kuakh are hypertension, cardiovascular diseases, diabetes, glaucoma, and neurological diseases. There is one dispensary which opens one day a week.

Our surveys in Kuakh (n=44) show the mean household income to be by far the lowest among the communities surveyed, at 327 273 LL per month (roughly 327 Canadian $ - sd 166638). The mean number of people living in the household was 7.1 (sd 2.1) and while respondents had an average of 6.5 children (sd 1.5), the mean number of children under 15 living in the household was 2.2 (sd 1.9).

Figure 10: Income histogram - Kuakh

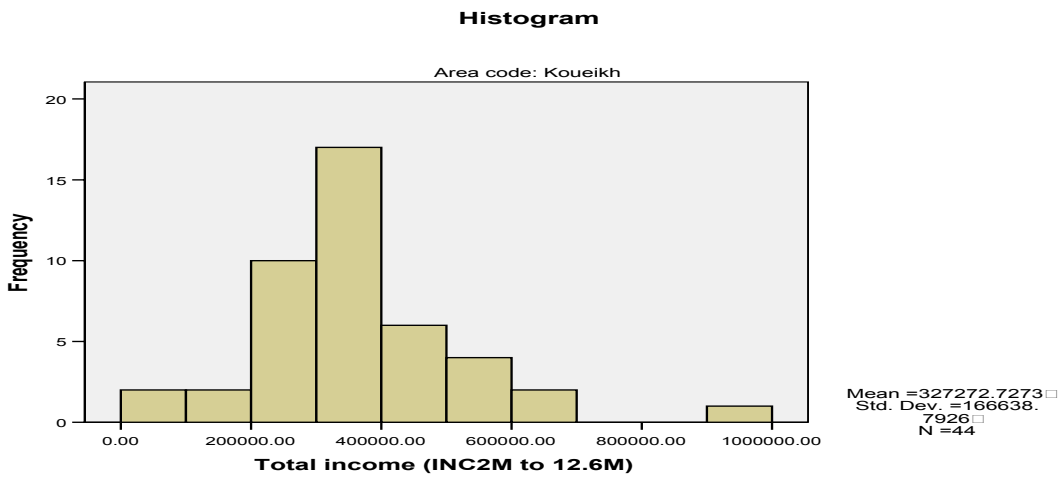


Figure 11: Present occupation - Kuakh

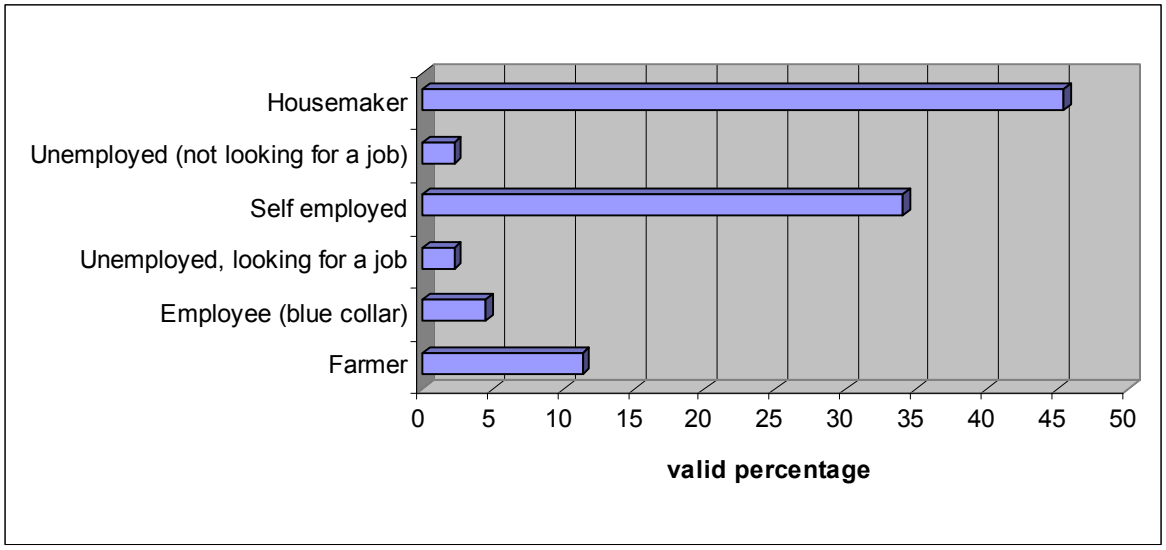
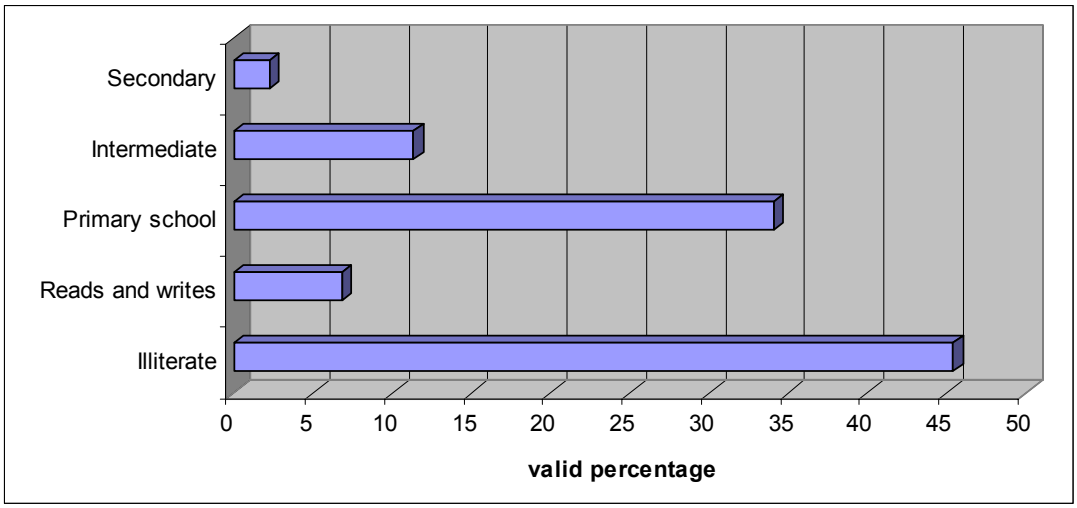


Figure 12: Educational level - Kuakh



The Chouf cluster

In the Chouf mountains of Mount Lebanon, three villages in close proximity were selected for surveying: Balloon, Kfar Nebraska and Warhaniyeh. General descriptions of each community are based on interviews with mayors and are followed by survey results for all three villages in the Chouf, which were analyzed as a group. The villages are approximately 60 km from Beirut.

Batloun

Batloun is located at an altitude of 1250 m above sea level. It is rich in groundwater; with a river that flows through the village. Covering 5.5 km², its predominant soils are red rose and clay. Vegetables and fruits are grown for local consumption and distributed in markets of Sidon. The most cultivated fruit trees are apple, peach, cherry, figs, almonds and grapes. Only small animals are raised for household consumption.

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Batloun's official population is 4500, of which 80% are residents. The main sources of income are from agriculture, governmental jobs, local trade and industries. There is one public school with kindergarten, elementary, intermediate and secondary levels, and a vocational school. Cultural and social events take place in Batloun Cultural Club.

The infrastructure is relatively good with a functional telephone system. Electricity is provided but restricted to a certain hours of the day. The sewage disposal system is of minimum quality. Water is provided from the Barouk springs by the city in limited quantities, augmented with water from artesian wells and delivered by private companies to holding tanks. According to key informants, the most frequent health problems in Batloun are hypertension, diabetes, and cardiovascular diseases. There are 4 clinics and 2 pharmacies.

Kfar Nabrakh

Kfar Nabrakh is located at 1000 m above sea level and has a moderate climate. Covering a land area of 4 km², it has an official population of 9000.

There are a wide variety of soils in Kfar Nabrakh including red rose, white clay and sandy, and it is rich in groundwater. The main source of income is agriculture, with some local industries including carpentry, stone quarrying, a printing press, and welding metal for cars. Vegetables and fruits are of the most widespread agriculture, but used mainly for local consumption only .The most cultivated vegetables and fruit trees are tomato, cucumber, onions, apple, peach, olive, cherry, fig, and grapes. Raising livestock, such as cows, and goats is a common practice in Kfar Nabrakh. Dairy and meat are produced for local consumption.

There is one public and one private school, each offering kindergarten, elementary, and intermediate levels. Electricity is provided sporadically and maintenance is not always available. However, the telephone system is good in the village. The sewage disposal system is of minimum standard. Drinking water is provided from the Barouk springs and distributed to approximately 50% of the houses. Household consumption water is provided from artesian wells and distributed to the houses.

The most frequent health problems in Kfar Nabrakh are hypertension, diabetes, and influenza. There are two medical clinics.

Warhaniyeh

Warhaniyeh is located at 1200 m above sea level with an official population of 3,000.

The soil in Warhaniyeh is made up of red rose and white clay soil and the climate is moderate. The most widespread agriculture is that of fruit trees such as apple, peach, and pear. Animal rearing is no longer common although certain villagers raise chickens and goats for their families. There are two factories in the village, one manufacturing frozen meats and the other burghul. Both sell to a predominantly Lebanese market.

Electricity and telecommunication network systems are of good quality and a sewage disposal system is available, though aging and insufficient. Drinking water is provided from Barouk springs but is not distributed to the whole village. There are no artesian wells in the houses and groundwater is not available. There is one elementary school in the village.

The most frequent health problems in Warhaniyeh are reported by key informants to be hypertension, diabetes, and goitre. There are no clinics or other health care facilities.

Chouf cluster

According to our surveys in the three villages of the Chouf cluster (n=200), the mean household income was 943 379 LL per month (943 Canadian $ - sd 869 283). The mean number of people living in the household was 4.4 (sd1.3) and while respondents had an average of 2.9 children (sd 1), the mean number of children under 15 living in the household was 0.9 (sd 1).

Figure 13: Income histogram - Chouf cluster

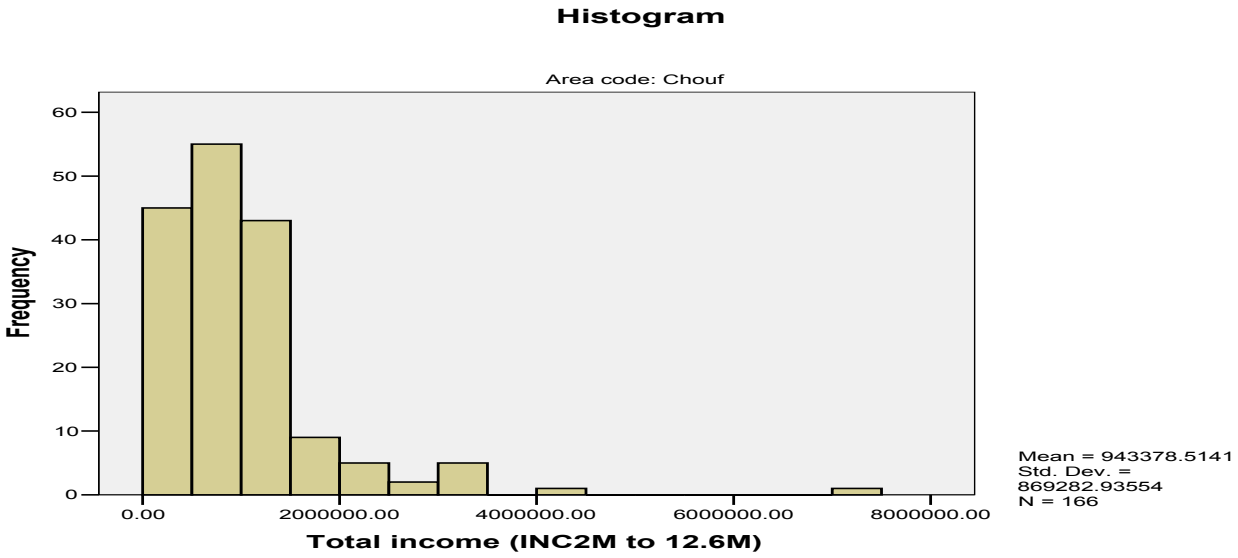


Figure 14 : Present occupation - Chouf cluster

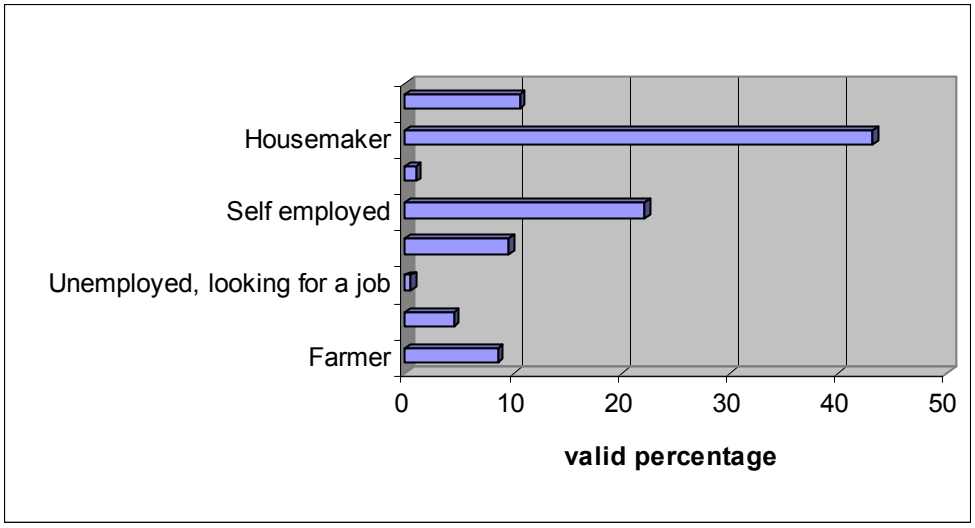
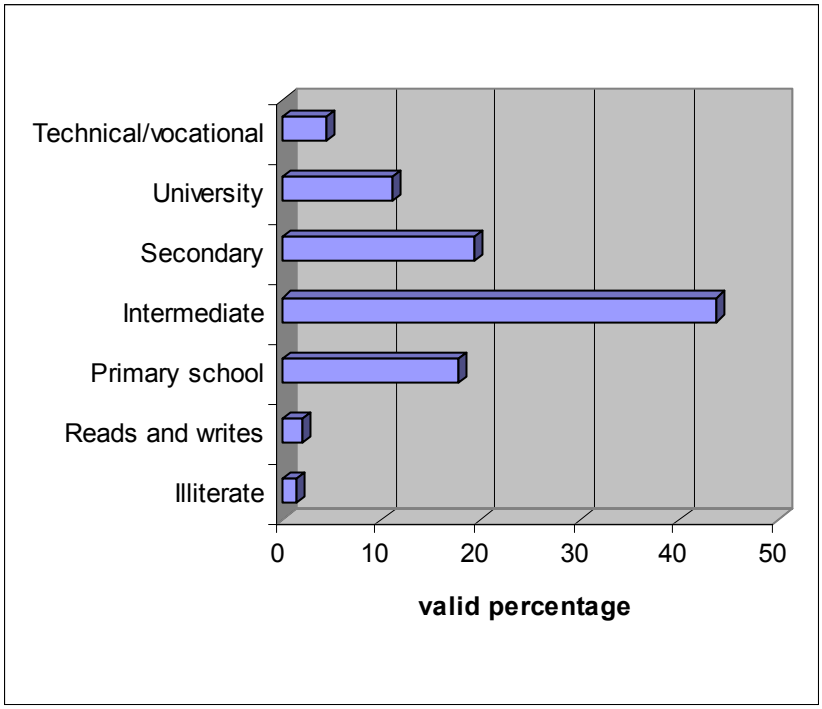


Figure 15 : Educational level – Chouf cluster



Comparison between communities

Figure 16: Present occupation – all communities

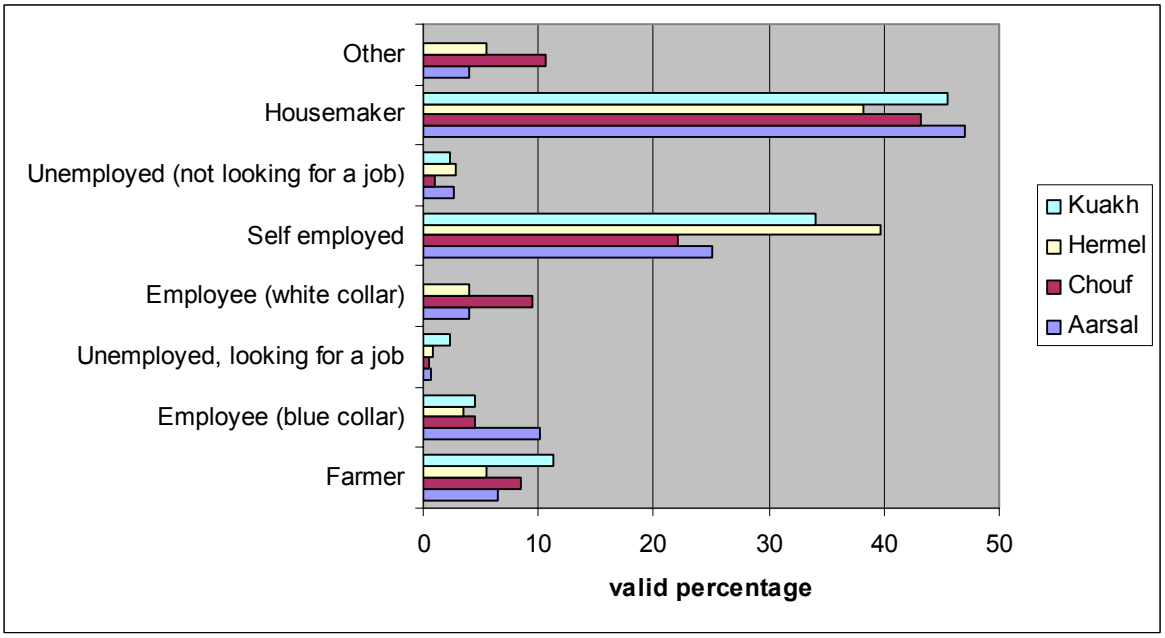


Figure 17: Education levels – all communities

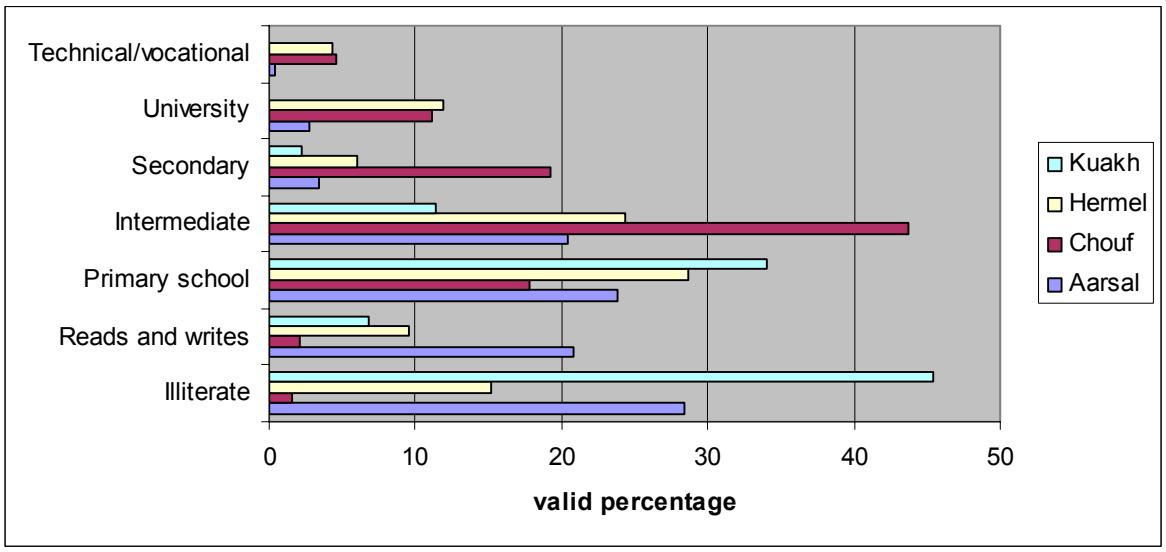
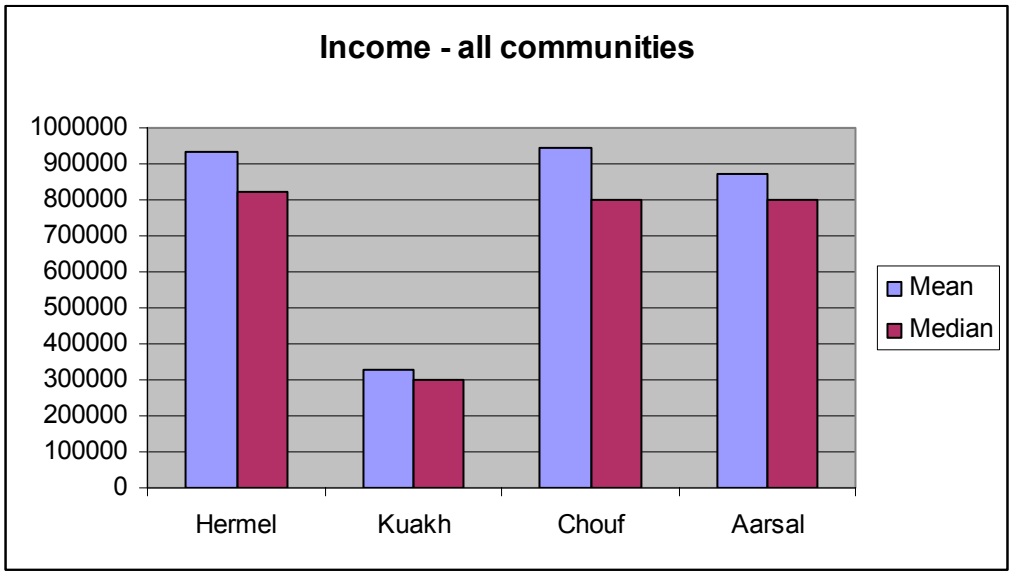


Figure 18: Comparison of mean/median incomes between communities



The following section uses descriptive results to address the hypothesis that more dietary diversity and higher rates of self-produced and self-gathered food lead to greater food security. A general description of the state of food insecurity, dietary diversity and food production/collection in the communities is followed by cross-tabulation and correlation results.

4.1.2 Descriptive results

Food security: experience of hunger or deprivation according to experiential measures

Although ten questions about food security were asked in the survey, our analysis focuses particularly on the 'quantitative' questions, both because answers are clearer and because they permit some comparison with rates in other countries.

In answer to a question about the occurrence of a situation where the food did not last and there was no money to buy more, 12.7 percent of respondents answered that it was sometimes or often true (Table 8).

Table 8: In the past 12 months the food we bought did not last and we did not have enough money to buy more of it

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Often true	5	1.3	1.3	1.3
	Sometimes true	43	11.3	11.4	12.7
	Never true	321	84.3	85.1	97.9
	Don't know or no answer	8	2.1	2.1	100.0
	Total	377	99.0	100.0	
Missing		4	1.1		
Total	381	100.0			

In answer to questions about skipping meals for lack of food, 6.4% answered that they were at times forced to do so (Table 9).

Table 9: In the past 12 months, did you or any member of your family skip a normal daily meal because you did not have enough food or money to buy food?

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Yes, almost every month	3	.8	.8	.8
	Yes, but only for some months	17	4.4	4.6	5.4
	Only for one or two months	4	1.0	1.1	6.4
	Never	349	90.6	93.6	100.0
	Total	373	96.9	100.0	
Missing		12	3.2		
	Total	12	3.1		
Total		385	100.0		

These results are somewhat surprising in light of typical response rates in other countries and given what we know about poverty in our three rural communities (see section 2.1 on poverty in Lebanon). For example, a recent national food security survey in Yemen indicated that in at least 21.7 percent of households, someone skipped at least one meal for lack of food in the past year (Kabbani and Wehelie 2004), while in our survey just 6.4 percent did so. While Yemen is clearly a poorer country than Lebanon, our survey specifically addresses low-income communities.

Comparisons with the US Household Food Security (Nord et al 2006) are also of interest. To an identical question in the 2005 survey asking if, in the past 12 months, it was often or sometimes true that the food bought did not last and there was not enough money to buy more, rates were very similar to those in our survey: 12.7 % of respondents answered affirmatively, compared to 12.2% of the US survey. On the other hand, 2.7% of our respondents indicated that they had gone a day without eating at least once in the past year compared to 1.3% in the US. To a question about whether they had skipped a normal daily meal in the past year, 6.4 % of our respondents answered yes, compared to 6.2% of US respondents who indicated they had either skipped a meal *or reduced the size of their meals* – in this case the question asked was not identical, making comparison difficult. .

When the food security questions are combined such that anyone who answered one of the five clear quantitative food security questions (FS1 part 3 or 4, FS2, FS4, FS5, FS9) positively was categorized as food insecure, approximately 19% of respondents are considered "food insecure" versus 81% who are "food secure". Table 10 shows the frequencies of people who answered these questions positively. This was used as the food security variable for logistic regression (see section 4.3).

Table 10: Number of clear quantitative food security questions receiving affirmative answer

	Frequency	*Percent*	*Cumulative Percent*
0	310	81.4	81.4
1	36	9.4	90.8
2	18	4.7	95.5
3	9	2.4	97.9
4	5	1.3	99.2
5	3	.8	100.0
Total	381	100.0	

Coping strategies

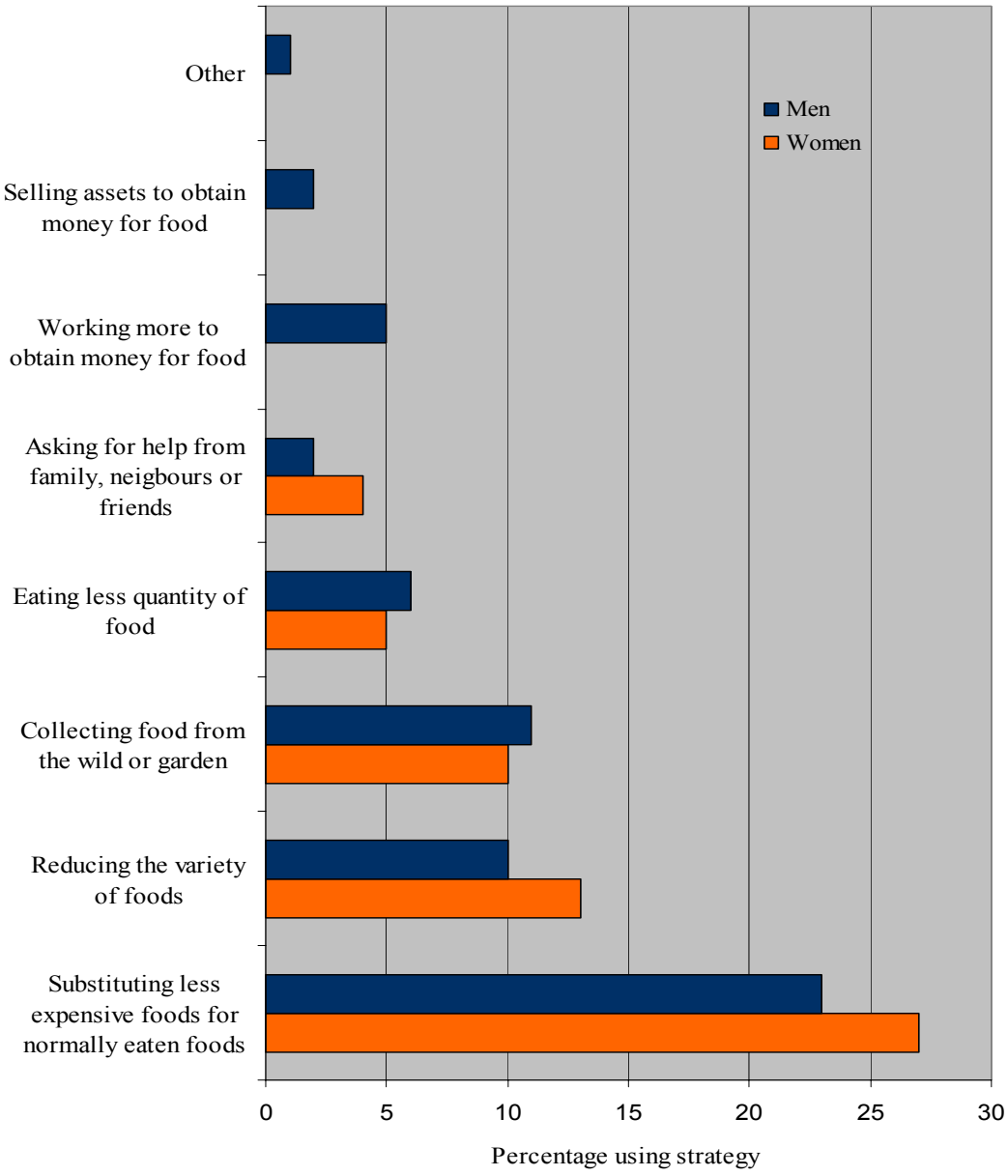
When food ran out, the most frequent coping strategies reported were to substitute less expensive foods, reduce the variety consumed, and collect from the wild or garden (Figure 17). Only respondents answering yes to the question of whether they ever foresaw running out of food/ money for food answered the question about coping strategies, accounting for 10.3 % (n=39) in the sample of households (women respondents). Cross-tabulation with other food security questions was done to verify that this group represents individuals who repeatedly report experiencing hunger or food insecurity according to other questions and this was indeed generally the case.

Note that Figure 17 reports coping strategies for female and male respondents which, although it duplicates many households, is interesting for the differences in strategies privileged[32]. Different strategies have different impacts on food consumption, nutrition

[32] Calculations were not done to verify whether these differences are significant or not.

and health: for example, while eating less would reduce caloric intake, reducing varieties or substituting less expensive foods could affect diet quality.

Figure 19: Coping strategies under food insecurity



Source: Results from question FS8 : *Did you ever foresee not having enough food for the next meal or for the next day because of lack of money? If yes, how did you cope*?

4.1.3 Collection of wild edible plants

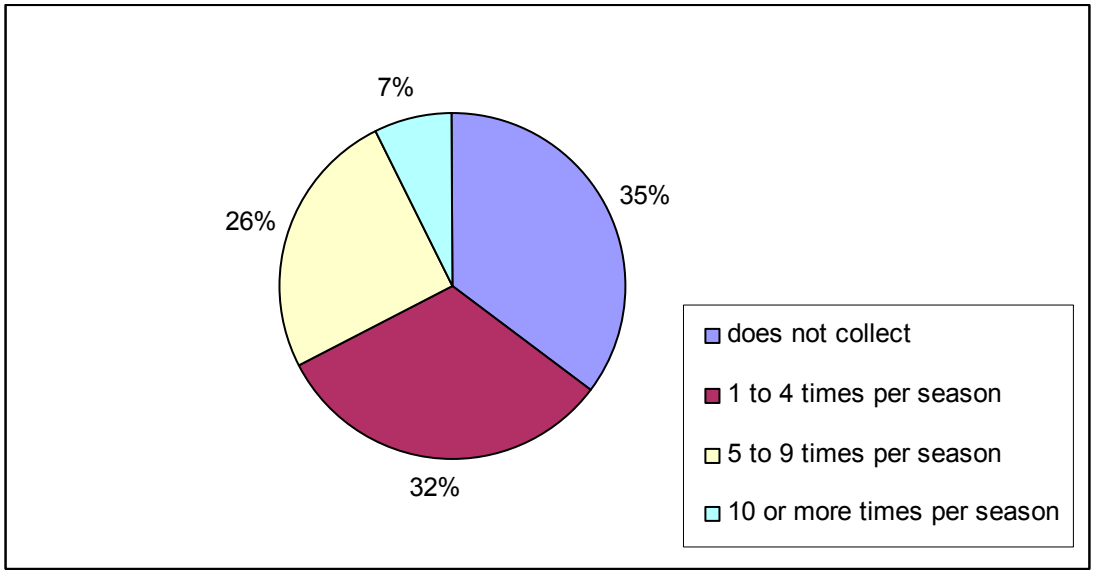
Nearly two thirds (65.3%) of people report collecting wild edible plants. However, half (49.4%) of those who collect wild plants report collecting them less than 5 times per season and only 7.4% collect more than 10 times per season. Differences between men and women in frequency of collection is slight and without any noticeable pattern. The vast majority of people (99.8%) eat the plants they collect; 31.5% report giving them to others and only .2% sell them. This coincides with the findings of the market survey, which concludes that wild plants are virtually unavailable on the public marketplace in these communities.

According to the survey, slightly more women (69%) than men (63%) collect wild plants, a surprising finding in light of the fact that collection has traditionally been practiced more by women than men. During the focus groups and field work, it was also women who were more involved in giving information about wild plants and their collection. However, the focus group meetings revealed that wild plant collection is most commonly a group activity. Particularly when the plants are not within walking distance or when it becomes a family outing, men would join in even if they perform collection less frequently than women. Nevertheless, only slightly more men than women said they never collect, and only slightly more women than men affirmed that they collect ten or more times per season (see Table 11 and Figure 18).

Table 11: Frequency of wild edible plant collection per season

	Frequency	*Valid Percent*	*Cumulative Percent*	*Male valid percent*	*Female valid percent*
none	271	35.2	35.2	37.2	33.0
1 to 4	246	31.9	67.1	29.3	34.9
5 to 9	197	25.6	92.7	2.5	2.5
10 or more	56	7.3	100.0	31.7	37.3
Total	770	100.0			
Missing	28				
Total	798				

Figure 20: Frequency of wild edible plant collection per season



4.1.4 Self-production of food

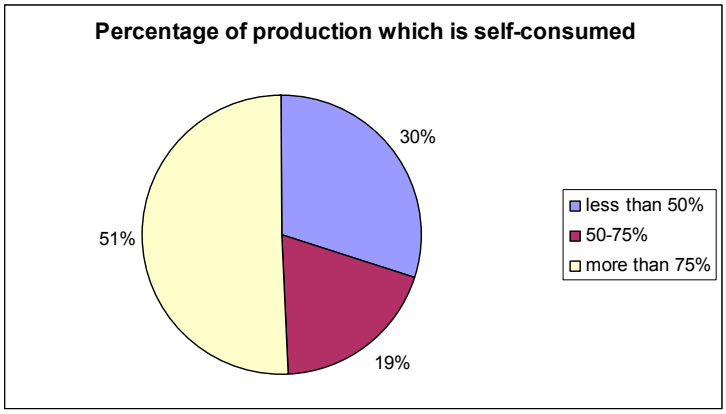
Of the 798 respondents in the general survey, 265 (33%) reported producing any kind of food (question DIE 4). Results for production of specific cultures/animal production are presented in Table 12:

Table 12: Agricultural production by type

	Frequency	*Percentage of total respondents (n=798)*
Fruits and vegetables	149	15.2
Milk	100	12.5
Chicken/eggs	76	7.8
Olives	42	5.3
Meat	1	0

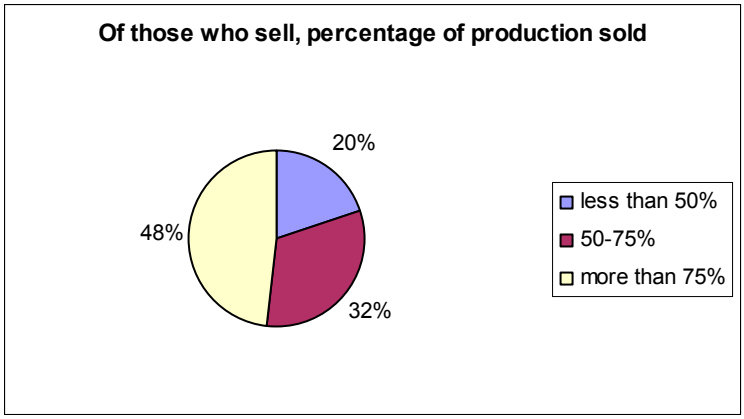
To the question of what they do with the food, 98.5% (261) of those who produce food, eat from it, but only 41.5% (110) report selling some of it while 51% (135) report giving some of it away. Of those who reported eating some or all of their production, nearly half (51%) eat more than 75% of what they grow (Figure 19).

Figure 21: Self-consumption of production



Of those who give away some of their production, the mean percentage given away is 15.5. Of those who sell some of their production, nearly half (48%) sell more than three-quarters of their production while only 20% sell less than half their production (Figure 20).

Figure 22: Percentage of production sold



Results of agricultural survey

Results of the agricultural survey given to a sub sample of 295 individuals are useful as a preliminary description of agricultural activity in the communities, but must be read with caution for several reasons. First, several discrepancies and gaps were noticed in the data, such as units of productive land being reported in measures ranging in number of trees (such that estimates had to be made), or reported numbers for cost of production not corresponding with production levels. Also, because these results were not integrated into

the main data base, it is not possible to perform many statistical analyses, such as sorting by gender, household or community. Finally, since in most households, one person from each gender was interviewed, the numbers reported below cannot be understood as representative of 295 households; the sample is likely to represent some 150-170 households although this cannot be confirmed.

Tables 13 summarizes the main livestock produced by respondent. Chicken and goat are the most common livestock raised and the numbers raised seem low given the importance of herding sheep and goats in some communities (Aarsal and Kuakh). However interviews with farmers revealed that there are a few shepherds who care for large herds, often including goats or sheep belonging to other people. If those individuals did not happen to be chosen for the agricultural survey, as it seems to be the case, results do not reflect this reality.

Table 13: Numbers of livestock producers:

Livestock	*Number who raise*	*Lowest number raised*	*Highest number raised*	*Median number raised*
Chicken	36	3	150	9
Goats	19	1	60	3.5
Birds	16	1	200	20.5
Cows	7	1	23	2
Lambs	5	4	305	8
Sheep	2	3	4	3.5
Rabbits	1	6	6	6
Total	**86**			

Table 14 summarizes the main crops produce. Clearly fruits and vegetables are the most common, although with relatively small land areas of 40-50 square metres on average. A lesser number of olive and nut producers grow on larger area (as required by those crops) and the very few bean and wheat producers have the largest areas.

Table 14: Numbers of crop producers

Crop	*Number who cultivate*	*Land area (m^2)*			*Annual outcome (kg)*		
		lowest	highest	median	lowest	highest	median
Vegetable	88	1	20	40	2	20000	208
Fruit	76	1	15813	50	8	9210	208
Olives	30	1	3125	500	0.5	3000	500
Nuts	27	1	12500	500	1	25000	800
Beans	4	1000	2000	1000	1000	2000	1700
Wheat	4	1000	17000	1500	600	2000	2000

Roughly the same number of producers use natural and chemical fertilizers (or both) and only one sixth (50/295) report using pesticides.

Table 15: Use of pesticides and fertilizers

	Number who use	*Amount used (kg)*			*Cost of use (LL)**		
		min	max	median	Min	max	median
Pesticides	50	.08	100000	9.5	4000	1500000	110000
Natural Fertilizer (manure)	51	1	9000	120	3000	900000	153000
Chemical Fertilizer	47	0.5	1500	7.25	7500	2000000	120000

*1000 LL = approximately 1$ Can

Results suggest that people buy seeds to approximately the same degree that they save them: 62 respondents reported buying versus 59 who saved their own, while only 4 reported obtaining them from neighbours. Note that these numbers include people who only save seeds, only buy them and those who do a combination.

The portrait emerging from these results is one of relatively urbanized rural communities in which only one-third of residents produce any food and of those who do, less than half sell any of their production. The small number of commercial farmers is confirmed by the question about current occupation (GEN7) in which only 55 respondents (of 798) classified themselves as farmers. Congruent with this observation is the fact that for most productions and notably vegetables and fruits, there are a few cases with large land plots and output and a majority which have very small plots and outputs, such that median outputs are relatively small. This is less the case for olives and nuts, for which there are a

larger portion of ‘large’ producers and the median outputs are larger. The portrait of many micro-producers and a few commercial ones concords with information about Lebanese farmers in general collected by the Ministry of Agriculture (Ministry of Agriculture 2005).

The food frequency questionnaire, in which respondents were also about the source of their food, also provides insight into self-production (Table 16). While certain foods such as almonds, pears and yogurt have high percentages of self-production, other foods are rarely or never self-produced. As expected, wild edible plants are largely self-collected, although the numbers are brought down by a few varieties such as thyme which are often cultivated and/or more widely available on the standard markets.

Table 16: Most frequently home-grown or homemade foods*

SOURCE OF…	**Percentage who grow it or make it**	Percentage who buy it from the market	Percentage who buy it directly from the grower
Almonds	**90.2**	1.1	8.7
Pears	**89.8**	3.5	6.7
Cooked laban (yogurt)	**88.2**	10.1	1.7
Wild birds	**83.3**	6.8	10.0
Wild prunes	**82.4**	0.0	17.7
Wild Edible Plants (average of 15 plants)**	**81.4**	16.9	7.5
Kicheck (fermented wheat and goat yogurt)	**81.1**	10.2	8.2
Grapes	**51.9**	44.5	3.1
Apricots	**48.4**	46.0	5.3
Cherries	**48.0**	45.7	6.1
Mint	**41.1**	56.8	1.8
Wheat bread	**39.2**	53.8	6.8
Cooked wheat	**38.4**	59.5	1.7
Figs	**38.4**	49.3	12.0
Shanklish (cow/sheep cheese)	**31.3**	46.3	22.4
Natural juice	**29.2**	65.4	5.1
Whole labneh (strained yogurt)	**28.6**	37.7	32.4
Ghee (clarified butter)	**27.4**	18.5	54.1
Tomato paste	**25.8**	69.4	3.3
Raspberries	**23.2**	68.6	7.9
Plums	**21.7**	74.4	3.9
Parsley	**21.7**	75.2	2.3
Radish	**21.6**	75.5	2.3
Rocca	**21.0**	66.8	11.9
Burghol (cracked wheat)	**19.7**	78.3	1.8
Almonds	**19.7**	75.5	4.2
Olive oil	**19.0**	49.4	31.1
Whole laban (yogurt)	**18.8**	37.8	42.5
Tomatoes	**17.3**	78.2	2.8
Pears	17.2	77.7	5.0

* Foods which are dishes rather than ingredients were eliminated from the list. Totals do not always sum to 100 as responses which listed several sources for an item represented small percentages and were eliminated.

**Wild edible plants were combined into one averaged number. For details on most frequently consumed plants, see Annex 4.

Note that the products most frequently purchased directly from the producer are dairy products. This may be a result of the higher quality of dairy products available from the small dairy processors in each community, as the market survey reveals that dairy products are available at most of the stores in the communities. Other products such as olive oil, ghee and kishek (cracked wheat and goat yogurt)

Figure 23: Foods most frequently bought directly from the producer*

SOURCE OF…	***Percentage who buy it directly from the grower***	*Percentage who grow it or make it*	*Percentage who buy it from the market*
Ghee (clarified butter)	**54.1**	27.4	18.5
Whole milk	**46.5**	14.2	38.0
Whole laban (yogurt)	**42.5**	18.8	37.8
Whole labneh (strained yogurt)	**32.4**	28.6	37.7
Olive oil	**31.1**	19.0	49.4
Shanklish (cow/sheep cheese)	**22.4**	31.3	46.3
Cheese	**19.1**	10.9	61.3
Wild prunes	**17.7**	82.4	0.0
Figs	**12.0**	38.4	49.3
Rocca	**11.9**	21.0	66.8
Fish	**11.0**	0.3	88.6
Wild birds	**10.0**	83.3	6.8
Almonds	**8.7**	90.2	1.1
Kicheck (fermented wheat and goat yogurt)	**8.2**	81.1	10.2
Red meat	**7.9**	2.0	90.1
Raspberries	**7.9**	23.2	68.6
Wild Edible Plants (average of 15)**	**7.5**	81.4	16.9
Wild cucumbers	**7.3**	16.5	75.8
Wheat bread	**6.8**	39.2	53.8
Pears	**6.7**	89.8	3.5
Broad beans	**6.3**	9.4	83.9
Cherries	**6.1**	48.0	45.7

* Foods which are dishes rather than ingredients were eliminated from the list. Totals do not always sum to 100 as responses which listed several sources for an item represented small percentages and were eliminated.
**Wild edible plants were combined into one averaged number.

4.1.5 Dietary Diversity

Results of the food frequency questionnaire reveal a heavy reliance on white bread (versus traditional cereals) and high consumption of sweetened tea and coffee, but also a diversity of vegetables and fruit. Dietary diversity results for the food item score (see section 3.2.2) revealed a mean score of 42.9 for men and 43.4 for women. Because the scores for each food item are reduced to a daily equivalent (see methodology above) and the count is made for items scoring higher than 1/7 (0.142), this can only roughly be interpreted as meaning that people consume 43 different food items in one week (Table 17).

Table 17: Total food item score

	Males	*Females*	*All*
N	413	385	798
Mean	42.9	43.3	43.1
Median	43	44	43
Mode	42	45(a)	45
Std. Deviation	10.5	10.9	10.5
Variance	103.4	119.5	111.1
Minimum	0	0	0
Maximum	68	68	68

The diagrams below show frequency of the food item score for men and women.

Figure 24: Food item score for women

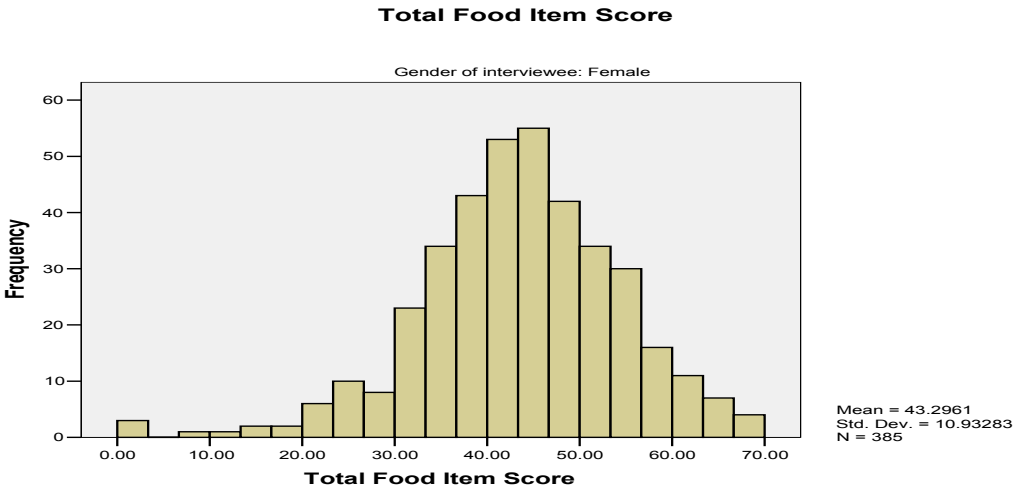
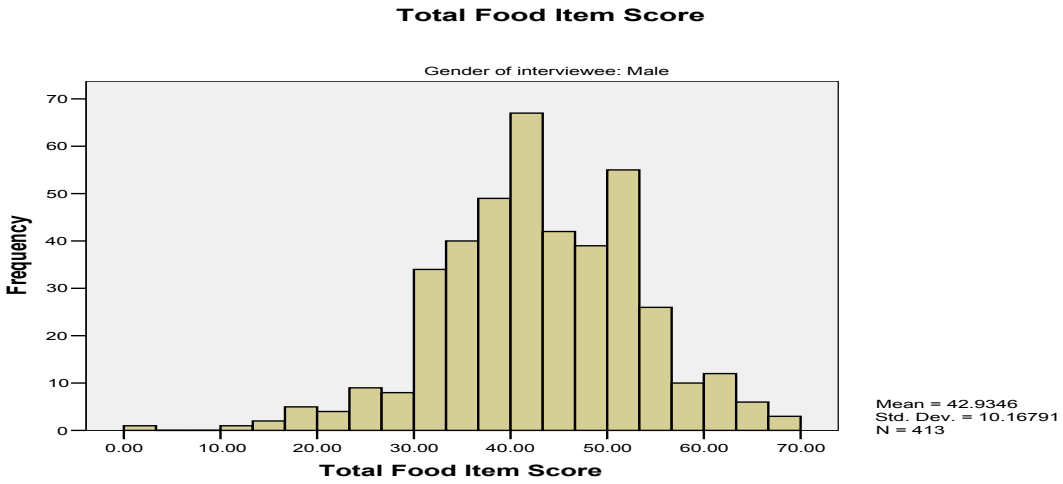


Figure 25: Food item score for men



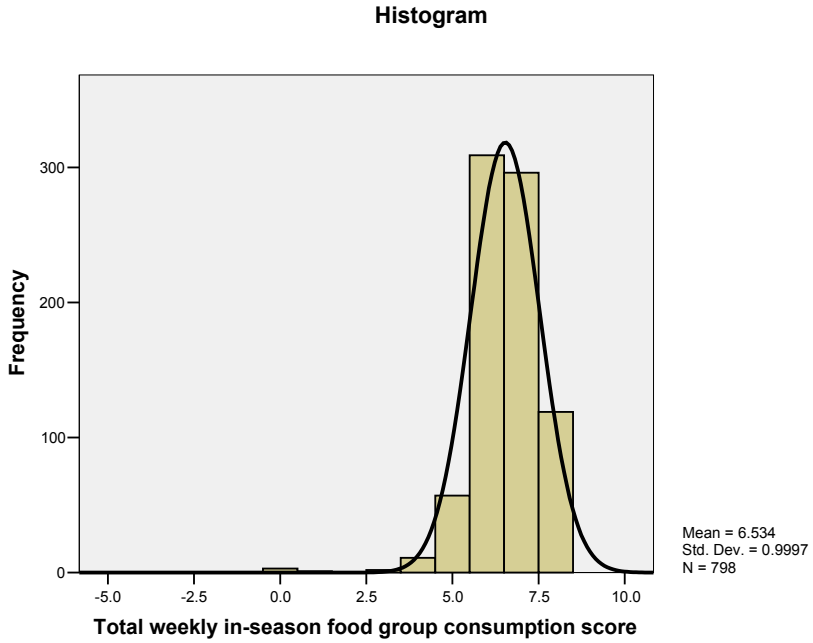
Results of the food group scores are also high: the mean number of food groups from which people consume is 6.5 (see Appendix 3 for detailed statistics). Frequencies of the food group consumption score are presented in table 18 and histogrammed in Figure 25. Note

that when the wild edible plants are included with vegetables, the mean number of food groups drops to 6.1.

Table 18: Weekly in-season food group consumption score

Number of food groups		*Frequency*	*Percent*	*Cumulative Percent*
Valid	0	3	.4	.4
	1	1	.1	.5
	3	2	.3	.8
	4	11	1.4	2.1
	5	57	7.1	9.3
	6	309	38.7	48.0
	7	296	37.1	85.1
	8	119	14.9	100.0
	Total	798	100.0	

Figure 26: Histogram, weekly in-season food group consumption score



While important methodological differences make comparisons with studies in other countries difficult, there is basis for believing that diets in these rural Lebanese communities are relatively diverse, as the following comparison with studies from Vietnam and Mali show (Table 19). It should be kept in mind that food frequency methodology (used in Lebanese and Vietnamese study) tends to overestimate food consumption while 24-hour recall generally underestimates it (Willett 1990). Our study was also conducted in summer, the period of greatest availability of varied fruits and vegetables. However, research on food frequency questionnaires in Shanghai suggests that while current diet intake influences the reporting of habitual past diet intake, the effect is not large enough to influence the interpretation of most epidemiologic studies (Fowke et al 2004).

Table 19:Dietary diversity scores - comparison with Vietnam and Mali

	Lebanon (our study)				***Vietnam* (7-day food frequency)***		***Mali* (23 day direct weighing)***	
		Mean	Median	SD		Mean		Mean
Food Item Score	68 food items	43.1	43	10.5	>120 food items	18\20**	75 food items	20.5
Food Group Score	8 food groups	6.5	7	11	12 food groups	8\9**	8 food groups	5.8

* reported in Ruel, 2003
** reported for two different seasons

4.1.6 Results from socio-economic questions

The mean total expenditure (1 180 877 LL) is higher than the mean income (893 043 LL), which is congruent with studies in other countries, due to underreporting of income. Histograms of both reported income and expenditures (Figures 25 and 26) shows a left-skewed distribution, which is also common for such distributions.

Figure 27: Income, all respondents (in Lebanese liras)

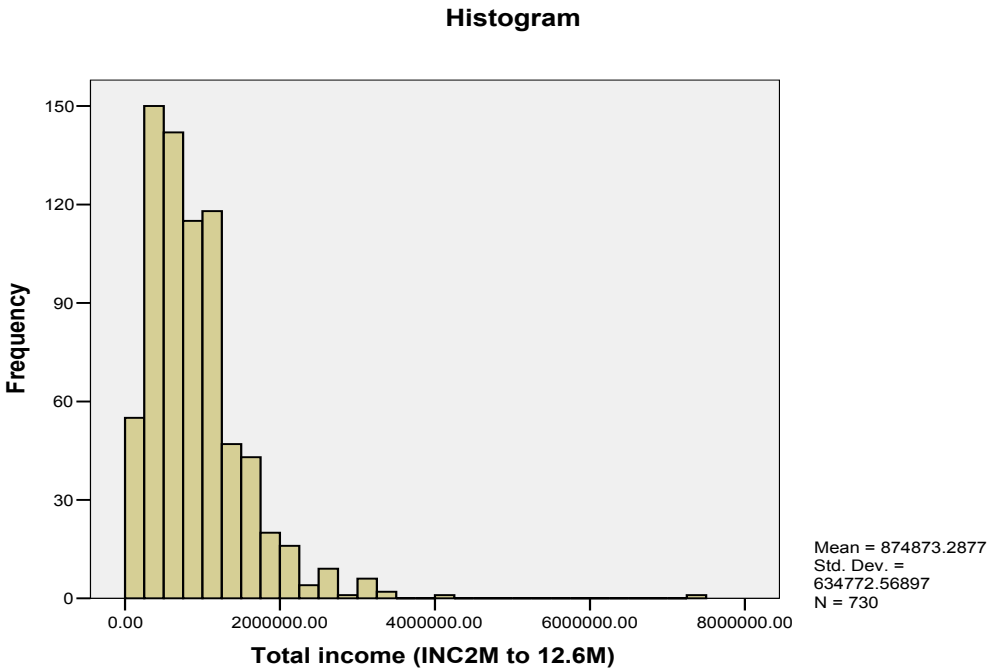
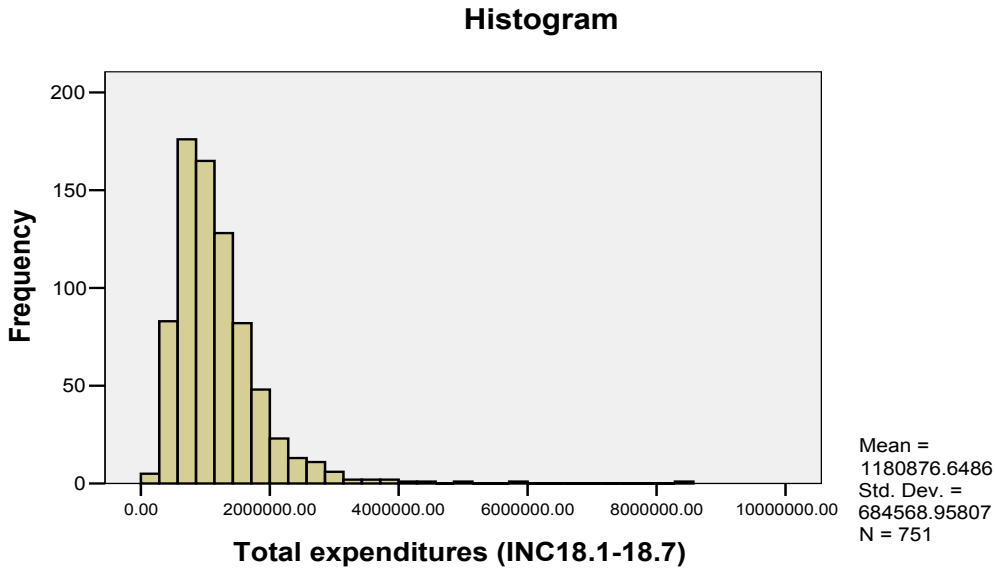


Figure 28: Expenditures, all respondents (in Lebanese lira)



Distribution of family income by category is quite congruent with the economic self-evaluation, (Figures 27 and 28) in which respondents predominantly categorize themselves in one of the two middle categories, with a smaller group categorized as poor and only 5 % categorized as rich.

Figure 29: Family income pie chart

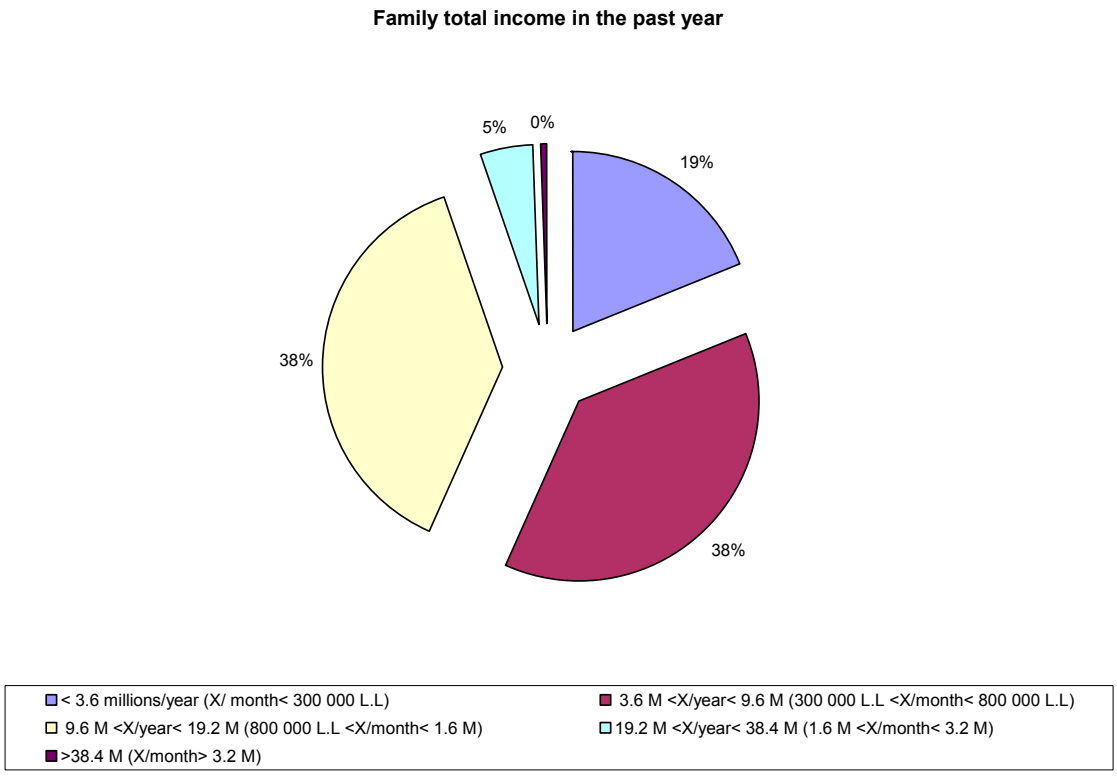
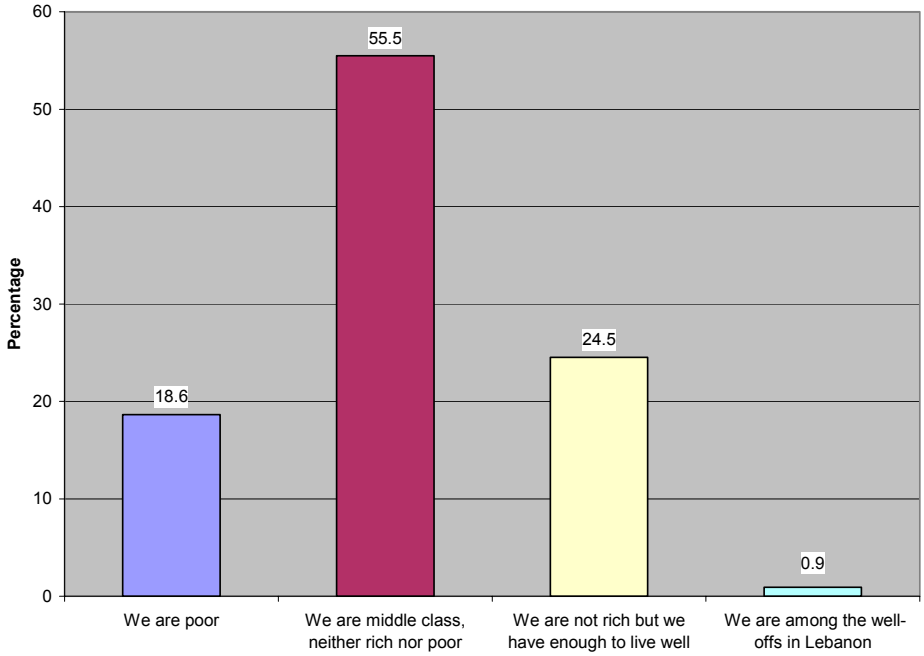


Figure 30: Economic self-evaluation



Finally, the distribution of respondents of respondents by educational level and marital status is presented (Figure 29 and 30). Over half (54%) of respondents have a primary school education or less, with proportionately far more women than men in the illiterate category.

Figure 31: Education background, men and women

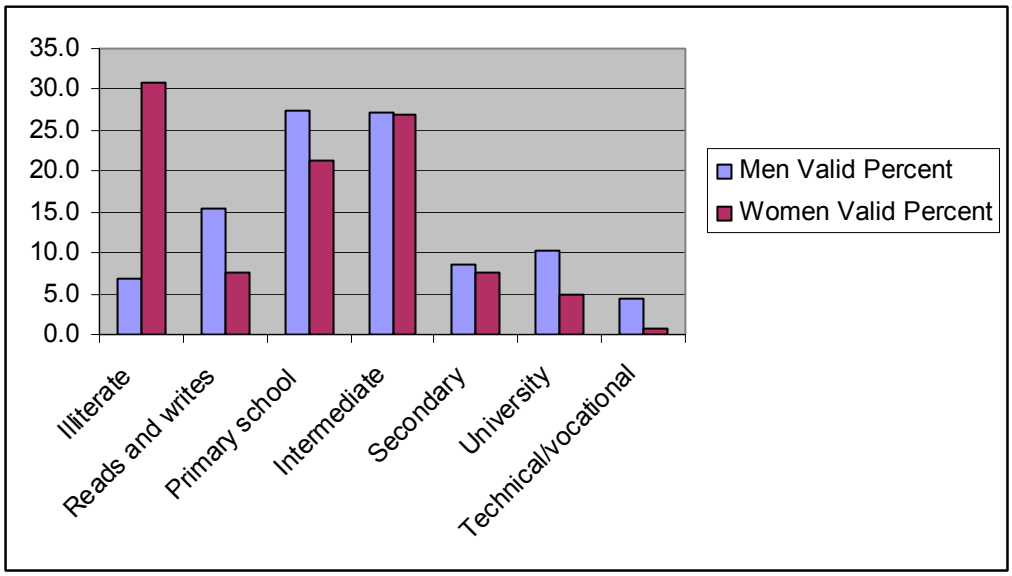
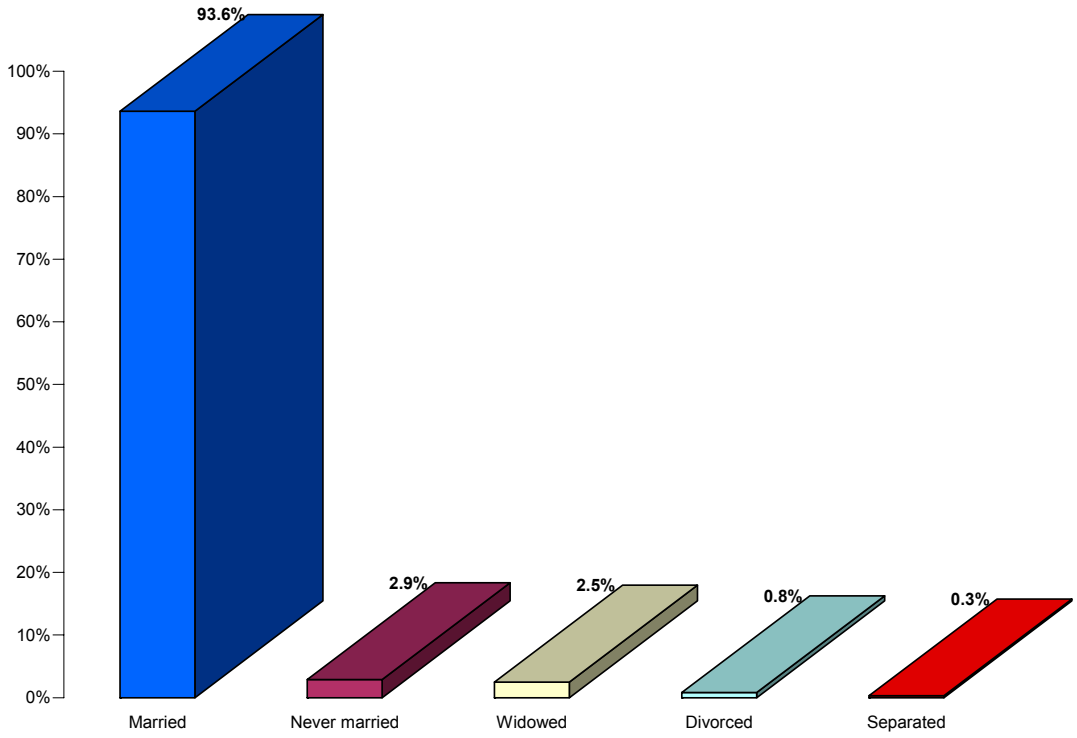


Figure 32: Distribution of respondents by marital status

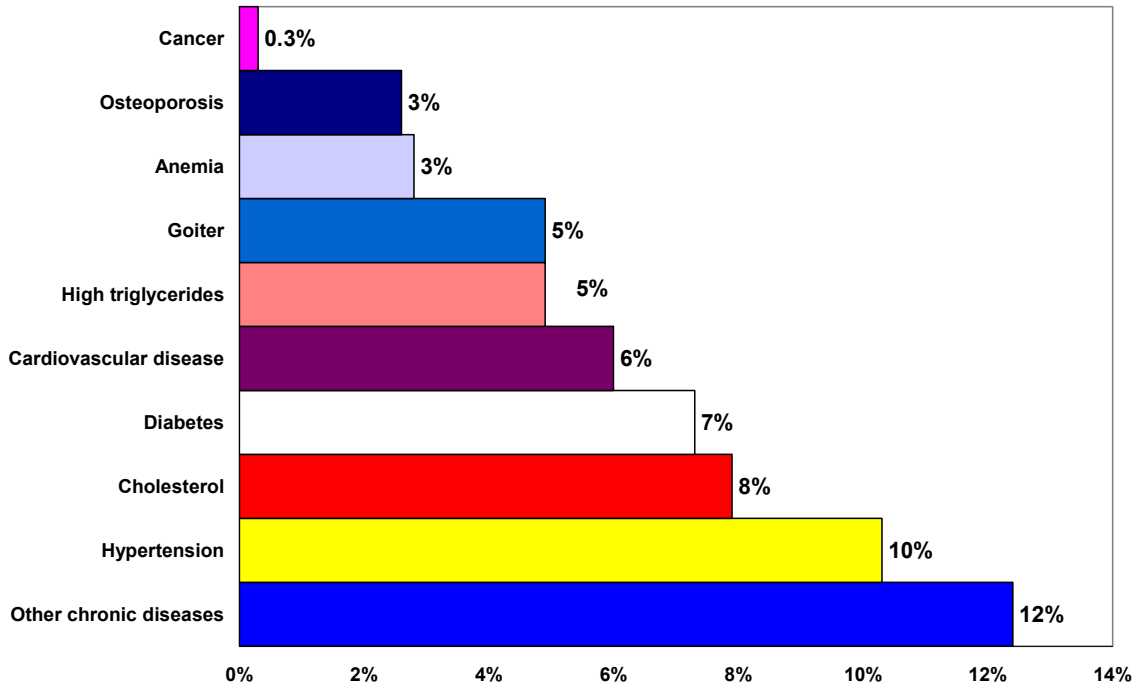


4.1.6 Summary of health results

Core to this project was the assessment of the nutritional and health status of the target communities. Although not a focus of the present thesis research, summary results are presented here. The study found:

-high rates of high blood cholesterol (23 and 28% for men and women respectively)
-extremely high rates of high blood triglycerides (60 and 64% of men and women respectively)
-high rates of high blood glucose (22% of both men and women, half of whom can be classified as diabetic), and
-high rates of overweight (44 and 36% of men and women respectively) and obesity (17 and 34% of men and women respectively).

Figure 33: Distribution of respondents by self-reported health problems



4.2 Cross-tabulation and correlation

Cross-tabulation and correlation test of principal variables were done to provide insight into the research questions before doing regression analysis. Results are organized by research question.

Are people sacrificing food quality (evaluated using dietary diversity as a proxy for food quality) in order to avert hunger or cut costs, and if so what are the economic reasons for food quality versus quantity trade-offs? Are people with greater dietary diversity more food secure? What are the characteristics of food insecure households?

Cross-tabulation of food group scores with food security status reveals a clear pattern in which more respondents with high dietary diversity (who eat from 6-8 food groups each week) are food secure than respondents with low dietary diversity (who eat from 0-5 food groups)[33]. Thus while 26% of respondents who were quantitatively food insecure had low dietary diversity, only 5% of food secure respondents had low dietary diversity. Inversely, while 95% of food secure respondents had high dietary diversity, only 74% of quantitatively food insecure respondents were classified as such.

Table 20 : Food security status versus food group score

Food security status*	**Total weekly in-season food group consumption score**									Total
	0	3	4	5	**Percentage with low dietary diversity (0-5 groups)**	6	7	8	**Percentage with high dietary diversity (6-8 groups)**	
Quantitatively Food Insecure	0	0	3	6		12	10	4		35
	9				**26%**	26			**74%**	
Qualitatively Food Insecure	2	0	6	31		132	108	35		314
	39				**12%**	275			**88%**	
Food Secure	0	2	2	19		155	168	79		425
	23				**5%**	402			**95%**	
Total	2	2	11	56		299	286	118		774**

**From FS1: "Quantitatively Food Insecure": the respondent answered yes to either "Sometimes we did not have enough to eat" or "Often we did not have enough to eat"*
"Qualitatively Food Insecure": the respondent answered yes to "We had enough to eat but not always the kinds of food we wanted"
"Food Secure" : the respondent answered yes to "We had enough to eat of the kinds of food we wanted"
**Numbers do not total to 798 because of missing values; in this case all respondents were used, minus the missing cases.

[33] Recalling that the food group score excludes foods such as sweets, desserts, unhealthy snacks and caloric drinks, it is theoretically possible for someone to survive while getting a score of zero, although it seems more likely that such scores are due to interviewing or data entry error.

However, correlation tests of the relationship between food security and dietary diversity were insignificant and regression results for this variable are mixed (see regression section below).

Cross-tabulation and correlation tests were also done between food security and several other variables in an effort to better understand the characteristics of food insecure households.

Correlation tests (using non-parametric tests as the data are generally not normal) were done between food security and education, housing variables (number of rooms, number of children, number of household members, crowding index) and hours worked, with no significant results. Food insecurity and income were negatively correlated, with a coefficient of -0.299 (using Spearman's rho). Food insecurity and wealth were also negatively correlated, with a coefficient of -0.179 (see appendix 5 for details).

Cross-tabulation was done between food security (using question FS1) and gender of the person interviewed, but results were insignificant. Virtually the same percentage of females (4.5%) were judged to be quantitatively insecure as males (4.3%). The same pattern appeared for qualitatively food insecure (38.8 % males vs. 40% females).

Cross-tabulation of the number of food security questions answered positively with the educational level of respondents reveals a pattern in which a larger percentage of respondents with intermediate education are considered food insecure than any other category. A more detailed analysis of the food security questions shows that even among those who responded affirmatively to two or three food security questions, there are proportionately more respondents with medium education (12/99 in the medium education category versus 6/114 in the illiterate category). The fact that the questions are not weighted by severity may at least partly explain this finding.

Table 21: Distribution of 'food insecure' respondents by education category

Percentage of those answering yes to one or more FS question by education category							
	Illiterate	Reads and writes	Primary school	Interme diate	Secon dary	University	Technical/ vocational
Percentage	20%	12%	18%	34%	21%	13%	0%
Respondents	19/95	2/25	12/67	25/74	5/23	2/15	0/3

Table 22: Number food security questions versus educational level

		Educational level							*Total*
		Illiter ate	Reads and writes	Primary school	Interme diate	Second ary	Univer sity	Technical/ vocational	
Number of quantitative FS questions answered yes	0	95	25	67	74	23	15	3	302
	1	10	1	6	12	2	2	0	33
	2	2	2	4	9	0	1	0	18
	3	4	0	1	3	1	0	0	9
	4	1	0	1	1	1	0	0	4
	5	2	0	0	0	1	0	0	3
Total		114	28	79	99	28	18	3	369

Does collection of wild plants protect people against food insecurity? Or inversely, do only people suffering food insecurity resort to collecting wild plants? Does gathering or producing food help to mitigate the quantity/quality trade-off?

Figure 34: Food security status vs. wild edible plant collection

		*Food security status**				
		Food secure	**%**	Food insecure	**%**	Total
How many times per season do you collect Wild Edible Plants?	1-4 times	212	**85%**	36	**15%**	248
	5-9 times	155	**78%**	43	**22%**	198
	10 or more times	39	**70%**	17	**30%**	56

*uses the dichotomous variable for food security described in section 3.2.1 of the methodology.

Of the food insecure households (n=367), 84.1% of respondents collected WEPs, compared to 63.1% of the food secure households. Cross-tabulation of food security with frequency of wild edible plant collection indicates that as the frequency of collection increases, the percentage of food insecure collectors increases. This finding can be explained by the endogeneity of the relationship between food insecurity and wild edible plant collection and is discussed further in the regression results.

Does self-production of food protect people against food insecurity? Or inversely, do only people suffering food insecurity resort to significant home food production?

Table 23: Food security status vs. food production

		Food Security Status		Total
		Food secure	Food insecure	
Do you produce any kind of food (plants, eggs, meat, milk...)?	Yes	220 (32.4%)	46 (40.3%)	266
	No	459 (67.6%)	68 (59.6%)	527
Total		679	114	793

*uses the dichotomous variable for food security described in section 3.2.1 of the methodology.

Of those who are food insecure, 40% produce their own food, of those who are food secure, 32% produce their own food. This suggests a relationship similar to the WEP collection although less pronounced: a higher percentage of food insecure people produce their own food, possibly masking any effect that self production may have on countering food insecurity.

There was no correlation found between self-production and food security status although there is a positive correlation with wild plant collection and negative correlation with education. This may be related to the fact that there are a large number of micro-producers and a few larger-scale commercial ones. Since the majority of "farmers" earn their main income outside farming, their food security status may be more related to outside income than to self-production. However, when those who skipped a meal or a day of eating were asked if it was in a specific season, of the 31 who answered, 27 (87%) answered that it was

during winter, which could be related to the agricultural season - but could also be explained by lower food prices or greater employment opportunities in summer.

4.3 Regression analysis

Of the 798 people interviewed, 601 were from households where two people were interviewed, almost entirely one man and one woman as was intended. In the remaining households, either one man (113 cases) or one woman (79 cases) were interviewed. The food security analysis uses only the women's responses so that responses in two-respondent households would not bear undue weight, and under the assumption that women are generally more knowledgeable about issues relating to household food consumption[34]. In the four cases where two women from the same household were interviewed, one woman from each household was eliminated from the sample. The woman with the highest education was retained, and in the one case where education level was the same for both, the older woman was retained. The sample for analysis was thus reduced to 381 cases.

All regressions are logistic. Logistic regression was chosen because the main outcome variable of interest, food security, did not have a large enough spread (variability) to warrant use of a continuous outcome variable. For example, only 48 out of 377 (12.7 %) respondents chose 'sometimes true' or 'often true' for the statement 'In the past 12 months the food we bought did not last and we did not have enough money to buy more of it' (see section 4.1.2). Results are reported for both the Beta and the exp B[35]. Most variables are dummies which can be interpreted in comparison to the omitted category, an approach considered appropriate when the relationship between the predictor and outcome variables is potentially non-linear.

[34] Some histograms (such as income) already presented above are reported again here for the lower sample numbers of households.

[35] Exp (B) is an indicator of the change in odds resulting from a unit change in the predictor, with odds defined as the probablility of an event occurring divided by the probability of that event not occurring. An Exp (B) value greater than 1 indicates that as the predictor increases, the odds of the outcome occurring increases, and vice versa for values less than 1.

The variables of primary interest are food (in)security, dietary diversity, food production and wild edible plant collection. Control variables which were considered important and were tested are: income (or wealth), education, age, employment, household size and number of children in the household. This section begins with a description how each of the control variables was constructed and its significance in the regressions. Then follows a description the construction of the four variables of interest and a presentation of the regressions that were run to test their interaction.

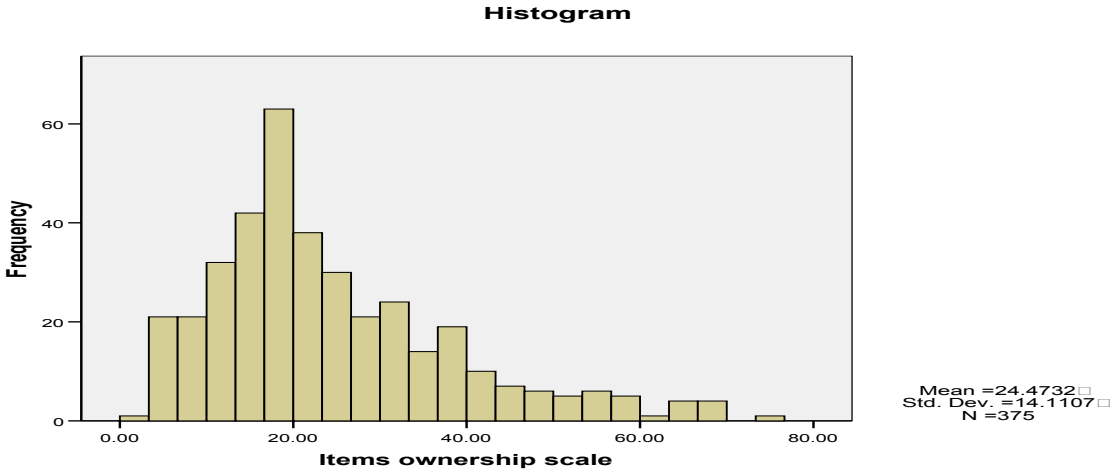
Income and wealth

Income was categorized using the first income question in the survey, in which respondents stated which of five numerical categories their income fell into; the highest two categories were combined to compensate for low frequencies. The omitted category is very low income.

-Very low - less than 3600 000 LBP (300 000 LBP per month)
-Low - 3 600 000 – 9 600 000 LBP (300 000 – 800 000 LBP / month)
-Medium - 9 600 000 – 19.2 million LBP (800 000 – 1.6 million LBP / month)
-Medium/ high – more than19.2 million LBP (more than 1.6 million LBP)

The ownership scale (wealth index) yielded scores between 0 and 76. Households were divided into four equal groups and labelled very low (0-15), low (16-21), medium (22-32) and high (33+) wealth. In regressions, the ownership scale yielded less significant results than the income variable and results are reported only for income.

Figure 35: Histogram of item ownership scale



Age variable

Although the age range for the respondents was intended to be 40-60, an abnormally high number of respondents were recorded with an age of 40 years, suggesting that younger participants upped their age (or interviewers did so) to be eligible for the survey. A dummy created for "40 year olds" was created.

Education variable

Three dummy variables were created: low education (reads and writes/ primary school), medium education (intermediate/secondary school) and high education (technical/vocational/university) with 'illiterate' omitted. Several different combinations of education level were tested (illiterate versus literate; illiterate/reads and writes versus any education) and most variables proved to be insignificant even at the 10% level. A few regressions found the 'any education' versus those with formal education to be significant at about the 10% level.

Table 24: Women's education regressed on food insecurity

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Income (very low omitted)						
low	-0.784	0.327	5.749	1	0.016	0.456
medium	-1.678	0.383	19.171	1	0	0.187
high	-2.37	1.06	4.998	1	0.025	0.093
Education (illiterate omitted)						
Any education	0.449	0.314	2.046	1	0.153	1.567
Constant	-0.93	0.301	9.549	1	0.002	0.395

Outcome variable is food insecurity (1=food insecure, 0= food secure)

Regressions using the more detailed breakdown of education levels, however, found respondents with 'medium' education to be more likely to be food insecure than illiterate respondents at the 1% level. This can also be seen in a cross-tabulation of the number of food security questions answered positively with the educational level of respondents reported in the descriptive results section (see Table 22). While the result is perhaps counterintuitive, one can speculate that illiterate respondents may have greater practical resources to deal with food insecurity that those with intermediate education.

Perhaps more importantly, our results are complicated by the fact that questions about education refer to the respondent while food security questions refer to the household, and the sample taken for analysis here includes only women. Analysis of the highest educational achievement within the household (not included in our questionnaire) or of the male interviewed in households where a man and a woman were both interviewed (beyond the scope of our study) may have yielded more significant results. As the education histogram shows (Figure 29), a much greater portion of women than men are illiterate.

<u>Household and children variables</u>

Categories were created with various combinations of household sizes were attempted but in general none were significant. In a few regressions, households with eight or more members were more likely to be food insecure than households with one member, but only barely at the 10% level. The 'number of children' variable was equally insignificant.

Analysis was also done of the ratio of children (age 15 or less) to adults and children to household members, with categorization done of more children than adults, same number of children as adults and less children than adults. Again, there was no significant result. In fact there are few households with a high child to adult ratio in spite of the relatively large households in the sample. This can be explained by the fact that respondents, in their 40s and 50s, have adult children who are often still living at home. When adult offspring bring in income, their presence would be likely act to prevent food insecurity, while if they are unemployed they may contribute to increasing food insecurity, making the overall effect fuzzy.

A crowding index was created (number of household members divided by number of rooms excluding kitchens and bathrooms) and run but proved to be insignificant.

Employment variable

An employed/not dummy was created using the categories of 'present occupation' (GEN 7). Those who classified themselves as farmers, employees (blue or white collar) or self employed were considered to be employed and the remaining categories (unemployed – looking for a job or not; homemaker, student and retired were considered to be unemployed.

The variable was insignificant, explainable by the fact that respondents are women and therefore the variable does not take into consideration the employment status of the men in the household[36]. Note that 92% of women who answered the question classified themselves as homemakers.

Food (in)security variable

Regressions with food *insecurity* as the outcome (dependant) variable were run with food security variable as a dummy coded 1 for all cases where people had answered positively to at least one of the clear quantitative food security questions (FS 1 sentence 1 or 2, FS2, FS4, FS5, FS9 – see questionnaire), and 0 for all others. This method has the weakness of weighting all questions equally and putting those who answered one question positively in

[36] For logistical reasons related to the larger project of which this is a part, it was not possible to link data for men and women in the same households.

the same group as those who answered five positively. However, weighting food security questions is of a complexity beyond the scope of this thesis (see Bickel et al for details of the US food security study which does so using Rasch modelling) and the use of a binary food security variable was considered adequate for this exploratory study.

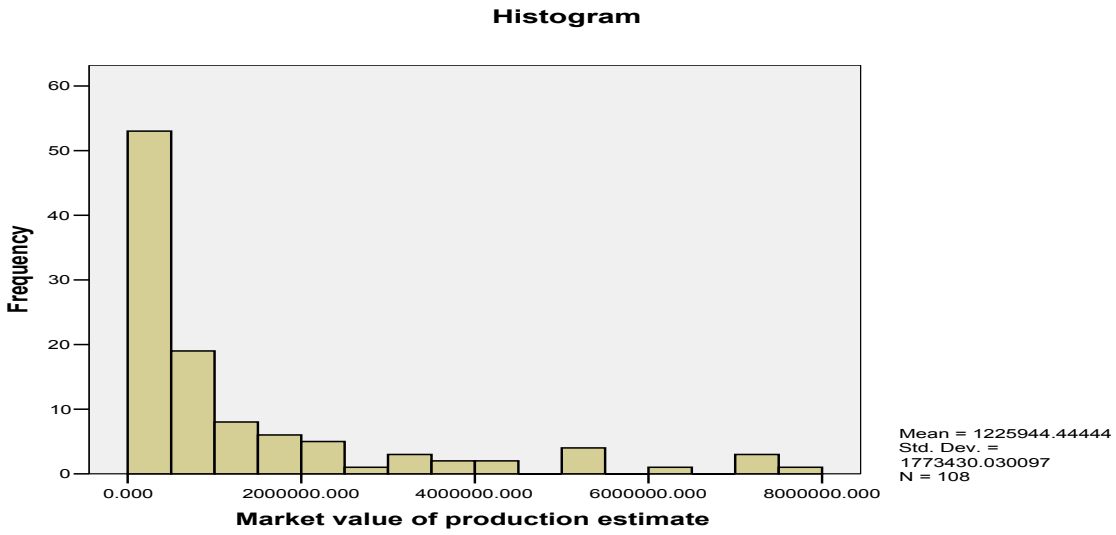
Wild edible plant collection variable

WEP collection was divided into three categories to create three dummies: those who don't collection WEPs, those who collect infrequently (1-4 times per season) and those who collect frequently (five or more times per season). No WEP collection was the variable for comparison.

Self-production of food

Only 108 of the 381 respondents produce any food. A histogram of these producers, based on answers to question DIE 4, illustrates the low production value for most people (Figure 35).

Figure 36: Estimated market value of food production



Self-production of food was categorized into four groups: those who do not produce, and those who produce low (less than 100 000LL per year - roughly 100Can$), medium (between 100 000LL and 1 million LL -100- 1000$ CAN) and high (more than 1 million - over 1000$ CAN) values. The categorization was created to both have easily understandable numbers and sizeable groups in each production category (see Table 25).

Table 25 : Production value categories

	Frequency	*Valid percent*
No production	256	70.3
Low production (less than 100 000LL/yr)	23	6.3
Medium production (100 000-1 million LL/yr)	56	15.4
High production (more than 1 million LL/yr)	29	8
Total valid	364	100
Missing	17	
Total	381	

Regressions on food security

Regressions were run for each of the variables of interest separately, followed by a final regression that combines them.

Control variables

The sign on the income coefficient is negative and the value of the coefficient increases with the amount of the income dummy. Thus, as would be expected, respondents with higher incomes are less likely to be food insecure compared to those with very low incomes. Recognizing that income can be endogenous to food security, a test regression was run without income (Appendix 6). Coefficients on the other variables did not change significantly.

The coefficient on age as a continuous variable was highly significant and positive, indicating that for each additional year older a woman is, the likelihood of being food insecure increases by 1.08 times. The "40 year olds" dummy was also highly significant, indicating that younger people are less likely to be food insecure, but is not presented.

Among the education dummies, the medium and high education variables are significant, suggesting that those with medium or high education are actually more likely to be food insecure than those who are illiterate – yet no such relationship shows up for those with lower education. One possible explanation is that, after having controlled for income and age, illiterate people have more tools to counter food insecurity that those with higher educations.

WEP collection

Results showed that those who collect WEPs are more likely to be food insecure than those who do not, the high WEP collection category having a slightly higher coefficient than the low WEP collection category. The endogenous nature of WEP collection discussed in the literature review in the context of food aid programs is well illustrated here: while it may indeed be that collection provides some protection against food insecurity, the fact that people who experience food insecurity tend to collect wild edible plants overshadows the 'protective' element. In other words, a household's level of food insecurity affects its decision to collect or not, resulting in a positive relationship that must be controlled for in order to assess the degree to which collection reduces hunger and food insecurity.

Controlling this positive relationship has been attempted with varying degrees of success in studies of US food assistance programs for example by using a two-staged procedure in which predicted program participation is used instead of actual participation in the food security equation, but is beyond the scope of this study (Kabbani and Yazbeck 2004).

According to the odds indicator (Exp(B)), the odds of someone who collects WEPS often being food insecure are 5.5 times higher than the odds of someone who doesn't collect WEPs being food insecure, while the same odds are 4.7 times higher for the infrequent collectors.

Table 26: Logistic regression on food insecurity: WEP collection

	B	S.E.	Wald	df	Sig.	Exp(B)
Education (illiterate omitted)						
Low education	0.486	0.435	1.248	1	0.264	1.626
Medium education	1.44	0.429	11.245	1	0.001	4.219
High education	1.581	0.784	4.06	1	0.044	4.857
Income (very low income omitted)						
Low income	-1.178	0.38	9.627	1	0.002	0.308
Medium income	-2.043	0.447	20.87	1	0	0.13
High income	-2.604	1.109	5.516	1	0.019	0.074
Age	0.079	0.025	9.996	1	0.002	1.082
WEP collection (no collection omitted)						
Less frequent WEP collection	1.43	0.485	8.688	1	0.003	4.179
More frequent WEP collection	1.567	0.467	11.242	1	0.001	4.791
Constant	-6.041	1.378	19.219	1	0	0.002

Food insecure = 1

Self Production

Using the production categories described above, only the low food production dummy was significant, indicating that compared to those who don't produce food, people who produce for low values (less than 100$ per year) are nearly three times more likely to be food insecure. Regressions were also run with self-production of food both as a dummy variable and as a production cost, but neither was significant.

Table 27: Logistic regression on food insecurity: food production

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Income (very low income omitted)						
Low income	-1.008	0.370	7.418	1.000	0.006	0.365
Medium income	-1.751	0.422	17.226	1.000	0.000	0.174
High income	-2.760	1.092	6.387	1.000	0.011	0.063
Education (illiterate omitted)						
Low education	-.043	.439	.010	1	.922	.958
Medium education	1.169	0.415	7.923	1.000	0.005	3.218
High education	0.973	0.741	1.727	1.000	0.189	2.646
Age	0.070	0.024	8.426	1.000	0.004	1.073
Value of food production (no production omitted)						
Low production value	1.063	0.510	4.345	1.000	0.037	2.894
Medium production value	-0.274	0.462	0.351	1.000	0.554	0.761
High production value	-0.298	0.625	0.227	1.000	0.634	0.743
Constant	-4.386	1.292	11.523	1.000	0.001	0.012

Food insecure = 1

Dietary Diversity

Regressions were run using two different measures of dietary diversity: number of unique foods consumed once per week or more frequently, and number of food groups from which respondents said they ate once per week or more frequently.

Regressions were first run using the number of total food items (DDS) which respondents said they consumed once per week or more frequently. The maximum value reported was 70 items and the mean value was 43.8. Dietary diversity was categorized as low DDS (1-39 items), medium (40-50) and high (51 plus) reflect the histogram pattern and create three roughly equally groups.

Histograms of the total food item diversity are similar for all households (first graph, n=381) and only the 'food insecure' households (second graph, n=133). However the food insecure households display a large, inexplicable dip in frequency in the 40-50 items range, mirroring the regression result.

Figure 37: Histogram of dietary diversity item score: all households

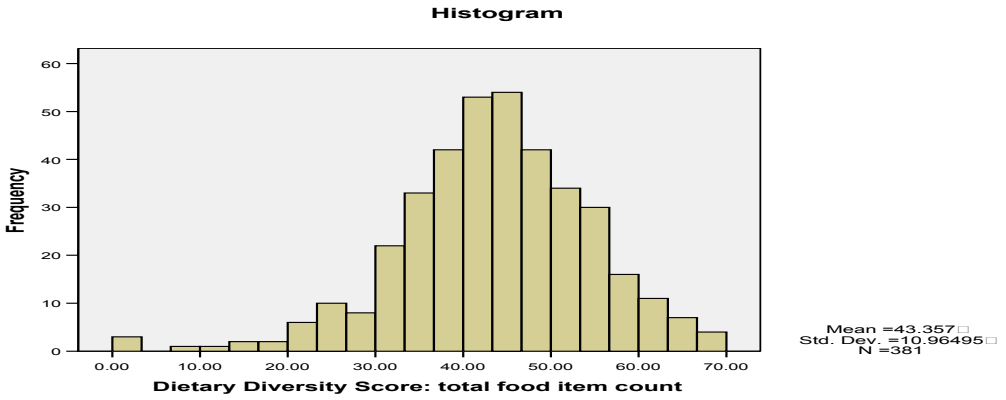
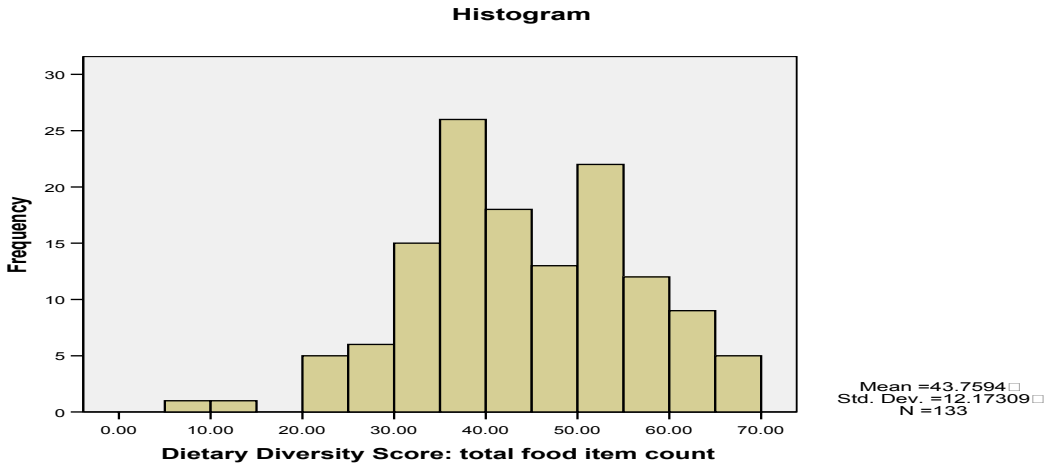


Figure 38: Histogram of dietary diversity item score : only food insecure households



Regression results reveal that compared with those of medium diversity, those with low dietary diversity are not significantly different while those with high diversity are significantly more likely to be food insecure - an unexpected response (Table 28). A plausible explanation is that respondents who avoid food insecurity buy larger quantities of foods that are cheaper or in season (possibly stocking up in the Lebanese tradition of ‘mouneh’ reserves).

Table 28: Logistic regression on food insecurity: dietary diversity item score

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Dietary Diversity using total item score (medium dietary diversity omitted)						
Low dietary diversity	0.82	0.67	1.499	1	0.221	2.271
High dietary diversity	0.92	0.33	7.778	1	0.005	2.509
Income (very low income omitted)						
Low income	-1.109	0.362	9.384	1	0.002	0.33
Medium income	-2.141	0.43	24.803	1	0	0.118
High income	-3.057	1.111	7.573	1	0.006	0.047
Education (illiterate omitted)						
Low education	0.252	0.421	0.36	1	0.548	1.287
Medium education	1.294	0.408	10.036	1	0.002	3.646
High education	1.243	0.749	2.757	1	0.097	3.466
Age	0.073	0.024	9.207	1	0.002	1.076
Constant	-4.798	1.299	13.641	1	0	0.008

Food insecure = 1

The regression was run again using food group count to measure dietary diversity (as described in methods section). The original categorization of food groups had wild edible plants as a separate food group; for these regressions WEPs have been included in the same group as other vegetables in order to avoid close correlation with the WEP collection variable in the later regression when all variables are included. Thus there are seven groups and a score of seven indicates that the respondent ate from each of the food groups within a one-week period. Because virtually no one ate from less than four food groups (see table below), the categories of interest are 4,5,6 and 7 food groups.

Results showed that respondents eating from five food groups or less are more likely to be food insecure than those eating from six or seven food groups, while it seems to matter little whether respondents eat from six or seven food groups in terms of their food security (Table 29). Two categories were created to illustrate this pattern: low food group diversity (five or less food groups) and high food group diversity (six or seven food groups). Compared to respondents with high food group diversity, those with low diversity are nearly four times more likely to be food insecure, and the coefficient is significant at the 1% level.

Table 29: Logistic regression on food insecurity: dietary diversity food group score

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Dietary Diversity (total item score)						
Five or less food groups	1.35	0.33	16.40	1.00	0.00	3.87
Income (very low income omitted)						
Low income	-0.89	0.36	6.14	1.00	0.01	0.41
Medium income	-1.67	0.42	15.65	1.00	0.00	0.19
High income	-2.72	1.13	5.85	1.00	0.02	0.07
Education (illiterate omitted)						
Low education	0.27	0.43	0.42	1.00	0.52	1.32
Medium education	1.40	0.42	11.29	1.00	0.00	4.04
High education	0.79	0.76	1.07	1.00	0.30	2.20
Age	0.07	0.02	9.16	1.00	0.00	1.08
Constant	-5.03	1.31	14.77	1.00	0.00	0.01

**food insecure = 1*

Thus the food group measure of dietary diversity indicates that it is positively correlated with food security as predicted, but the total item count measure does not. From a nutritional standpoint, the food group measure is a more meaningful one: a high score on it indicates a balanced diet. The simple item count score could be misleading, as a person consuming pasta, rice, potatoes, bread and corn would receive the same score as another person consuming burghol, apples, meat, eggs and spinach.

To get beyond the potential contradictions of the food item score, the regression was rerun with eight new variables, one for each of the food groups (Table 30). These variables are numerical with different maximum scores depending on the numbers of foods listed in each group in the food frequency questionnaire. Meat and wild edible plants scores were significant at the 1% level while oils was significant at the 6% level; all others were insignificant.

The meat score results indicates that adding one more type of meat decreases the odds of being food insecure by nearly 0.26. Similarly, adding one more type of oil consumed decreases the odds of being food insecure by about 0.27, though with less certainty.

WEP consumption has the opposite pattern, to a much greater degree: those who consume large varieties of wild edible plants are more likely to be food insecure, though as discussed

above the causal relationship is complex. Adding one more variety of WEP increases the odds of being food insecure by 2.3. Because of co linearity between the WEP collection variable and the WEP score, the regression was run without the WEP collection variable.

Table 30: Logistic regression on food insecurity: individual food group scores

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Individual food group scores						
Starches score	20.147	25129.449	0.000	1.000	0.999	562035691.613
Meat score	-1.321	0.340	15.080	1.000	0.000	0.267
Fruit score	-1.260	1.147	1.207	1.000	0.272	0.284
Vegetable score	19.911	19840.477	0.000	1.000	0.999	443928587.879
Legume score	0.056	0.322	0.030	1.000	0.863	1.057
Dairy score	0.252	0.943	0.071	1.000	0.789	1.286
Oil/fat score	-1.320	0.702	3.542	1.000	0.060	0.267
Wild edible plant score	0.827	0.324	6.534	1.000	0.011	2.287
Income (very low income omitted)						
Low income	-0.855	0.384	4.965	1.000	0.026	0.425
Medium income	-1.400	0.451	9.643	1.000	0.002	0.247
High income	-2.650	1.132	5.481	1.000	0.019	0.071
Education (illiterate omitted)						
Low education	0.263	0.447	0.345	1.000	0.557	1.300
Medium education	1.379	0.443	9.673	1.000	0.002	3.969
High education	0.638	0.830	0.591	1.000	0.442	1.893
Age	0.081	0.025	10.151	1.000	0.001	1.084
Constant	-42.490	32017.709	0.000	1.000	0.999	0.000

Food income = 1

Finally, the regression on food security was rerun with all of the variables of interest (in the case of dietary diversity, the food group variable was selected) as well as the control variables (Table 31).

Table 31: Logistic regression on food insecurity: all variables

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
WEP collection (no collection omitted)						
Less frequent WEP collection	1.380	0.503	7.534	1.000	0.006	3.974
More frequent WEP collection	1.500	0.499	9.039	1.000	0.003	4.482
Dietary diversity: number of food groups consumed from weekly (0=6-8 groups)						
Five or less food groups	1.475	0.387	14.522	1.000	0.000	4.372
Value of food production (no production omitted)						
Low production value	0.850	0.550	2.390	1.000	0.122	2.341
Medium production value	-0.493	0.513	0.927	1.000	0.336	0.610
High production value	-0.813	0.727	1.250	1.000	0.264	0.443
Income (very low income omitted)						
Low income	-1.052	0.420	6.278	1.000	0.012	0.349
Medium income	-1.622	0.484	11.252	1.000	0.001	0.198
High income	-2.237	1.133	3.898	1.000	0.048	0.107
Age	0.076	0.026	8.237	1.000	0.004	1.079
Education (illiterate omitted)						
Low education	0.179	0.479	0.139	1.000	0.709	1.196
Medium education	1.299	0.460	7.979	1.000	0.005	3.665
High education	1.106	0.856	1.672	1.000	0.196	3.023
Constant	-6.213	1.462	18.067	1.000	0.000	0.002

Food income = 1

All results were similar except for the self-production coefficient which became insignificant. This probably reflects an endogeneity problem of WEP production with the own-production, which is confirmed when non-parametric correlation is run on the number of collection times per season with the estimate of the market value of food production (Table 32).

Table 32: WEP collection versus market value of production correlation

			How many times per season do you collect WEP?	*Market value of production estimate*
Kendall's tau_b	How many times per season do you collect WEP?	Correlation Coefficient	1.000	.155(*)
		Sig. (2-tailed)	.	.028
		N	363	106
	Market value of production estimate	Correlation Coefficient	.155(*)	1.000
		Sig. (2-tailed)	.028	.
		N	106	108
Spearman's rho	How many times per season do you collect WEP?	Correlation Coefficient	1.000	.213(*)
		Sig. (2-tailed)	.	.029
		N	363	106
	Market value of production estimate	Correlation Coefficient	.213(*)	1.000
		Sig. (2-tailed)	.029	.
		N	106	108

* Correlation is significant at the 0.05 level (2-tailed).

4.5 Basket Results

Basket results are aimed at testing the hypothesis that healthier, diverse diets are within the economic reach of people in these communities. Results of nutritional analysis revealed that the regular basket is already relatively 'healthy' and diverse. It is however important to note that our methodology only approximates actual average intakes, as it is based on an unquantified food frequency questionnaire complimented by a sample of 100 24-hour recalls to obtain quantities. Given that food frequencies generally overestimate energy intake while 24-hour recalls tend to underestimate it (Willett 1990; Eurofir 2006), comparisons with nutritional standards must be made cautiously.

Nevertheless, comparison of nutrient analysis of the normal basket with recommended daily allowances from the United States suggests that diets in our communities are already adequate, as the normal basket nearly reaches or exceeds the average Dietary Reference Intake (DRI) for this age group in all categories of nutrient content except calories, of which it has a lower level (see Table 32).

Caloric levels obtained are close to the FAO cut-off for countries judged to have very low level of food consumption, those with under 2 200 kcal per day, of which there are currently 30 in the world, mainly in sub-Saharan Africa. The world average kcal/person/day is currently 2 800 kcal (FAO 2003a). However, FAO data are expressed per capita and based on disappearance data[37] which approximates food available for consumption rather than actual food intake. Food disappearance data overestimate actual per capita consumption because they include spoilage and waste accumulated in the marketing system and in the home as well as some food that is not available for human consumption such as pet food ingredients (Putnam and Allshouse 1992). Thus, FAO data cannot be compared with actual intake which is a better determinant for dietary intake.

Finding that older residents of rural communities in Lebanon have a relatively healthy diet is in keeping with one aim of the American University of Beirut/IDRC project, which was to find ways to preserve traditional food culture including wild plants. We can speculate that the 'unhealthy' aspects of the diet are partly responsible for the diet-related health problems in these communities. Our survey confirmed some of these problems including high rates of obesity and cardiovascular disease. Studies have confirmed that obese individuals tend to underreport food intake (Mendez, Wynter and Wilks 2004, Rennie, Jebb and Wright 2005); hypothesizing that this phenomenon is present in our population would help explain the discord between a relatively healthy diet on paper and negative health outcomes. It is also important to note that the basket presumes that food is eaten entirely at home, ignoring food eaten in restaurants or from street vendors. While this rural population evidently consumes more at home than their urban counterparts, there may

[37]"Disappearance" data are obtained by deducting data on exports, year-end inventory, and non-food use from data on production, imports, and beginning inventories. Annual disappearance figures for a food commodity is divided by the national population and by 365 days to obtain a per capita estimate of food available for consumption per day

nevertheless be significant consumption of high-fat foods outside the home, particularly for residents of the larger towns or those who commute to larger towns for work.

Table 33: Nutritional evaluation of baskets

Basket Analysis			
Nutritional Evaluation (daily)			
	Normal Basket	Healthy Basket	Average DRI*
Calories (Kc)**	2257	2370.9	2471.5
Saturated Fat (gm)***	21.1 (8.4 % of Kc)	16.5 (6.2% of Kc)	
Niacin (mg)	25.1	26.1	15
Total dietary Fibre(gm)	27.6	47.5	28.5
Vitamin C (mg)	158.5	196.9	82.5
Vitamin A (retinol equivalent)	1135	1092	800
Vit B12(Ug)	2.3	2.7	2.4
Folate(Ug)	425.7	605	400
Iron (mg)	12.7	23.3	10.5
Magnesium (mg)	438.5	662.8	370
Zinc (mg)	13.5	18.6	9.5
Calcium (mg)	1114	1198.3	1100
Caffeine (mg)	181.6	62.2	

*Average Dietary Reference Intake is calculated from the average of four categories: male-31-50, male- 51-70, female-31-50, female-51-70) in the Dietary Reference Intake series, National Academies Press. Copyright 1997, 1998, 2000,2001,2002,2004, by the National Academies of Sciences.
** Caloric requirements are Estimated Energy Requirements based on the average of requirements for 40 and 60 year old males and females.
***grams are converted to kilocalories by multiplying by 9 for fats

It is clear that the healthy basket has a healthier profile than the normal basket. It has substantially lower levels of saturated fat and caffeine. Saturated fat content, which should represent less than 7% of caloric intake (NCEP 2001), is under the mark for the Healthy Basket (6.2%) but represents 8.4% of the normal basket. Calories are slightly higher than in the normal basket, but still lower than the DRI (now used instead of Recommended Daily Allowance). The healthy basket also has higher levels of dietary fibre, vitamin B12, folate, vitamin C, iron, magnesium, zinc and calcium. Vitamin A is however slightly lower in the healthy basket, due to lower levels of vitamin A in low-fat labne. Overall, it seems that relatively small changes in the basket make important nutritional improvements.

In spite of the important nutritional improvements of the healthy basket, the price difference with the normal basket was small. The average price difference was roughly 1700 LL (1.7 Canadian dollars) per week, per household and represents a cost increase of 5.6% over the normal basket. Note that the overall price difference is due almost entirely to figures from the Chouf cluster, where the lower price of the normal basket and higher price of the healthy basket combine to make for a price difference of 3270 liras (Table 35).

Table 34: Comparison of basket cost between communities

COST	*Aarsal*	*Hermel*	*Chouf*	***Average***
Weekly Cost Normal Basket (LL) - average adult	27020	30109	28625	**28576**
Weekly Cost Healthy Basket (LL) - average adult	27073	30249	33567	**30297**

While a few thousand liras (a few dollars) may be a small price to pay for a healthier diet, a few individual items are responsible for much of the difference and can seem large to the shopper. For example, the average cost of white bread (large loaves) in the three communities where the market survey was done (Batloun/Arsal/ Hermel) was respectively 1460 / 1160 /1460 LL, compared to the cost of brown bread at 2650 /1460 /1530 LL. Thus whole wheat bread is everywhere more expensive, in some cases 45% more expensive. However, as seen in Table 16, 39% of respondents who ate wheat bread affirmed that they made it themselves, reducing the cost considerably.

Table 35: Comparison of basket item costs

Item	*Average Cost Normal Basket (LL)*	*Average Cost Healthy Basket (LL)*
whole wheat bread	**1418**	**2875**
white bread	**959**	**0**
cheese processed	**3373**	**0**
cheese white	**0**	**2367**
labneh (strained yogurt)	**2324**	**0**
low fat labneh	**0**	**3261**
whole laban (yogurt)	1578	1578
margarine	25	25
whole milk	**475**	**1599**

vegetable oil	**35**	**0**
garlic	19	19
olive oil	**66**	**249**
potatoes	324	324
cucumbers	340	340
cucumbers (summer)	165	165
lettuce	92	92
broad beans	603	603
tomatoes	374	374
tomato paste	426	426
fava beans	90	90
hindbeh	67	67
cabbages	80	80
parsley	31	31
mint	9	9
eggplant	135	135
beans	119	119
onions	92	92
radish	6	6
bakleh	46	46
thyme	1	1
figs	100	100
cherries	1146	1146
grapes	386	386
apricot	742	742
bananas	42	42
musk melon	133	133
strawberries	204	204
mulberries	**212**	**233**
plums	255	255
almonds	148	148
unsalted peanuts	**0**	**1075**
mixed nuts	**620**	**0**
kicheck	1558	1558
burghol (cracked wheat)	**11**	**30**
chickpeas	11	11
chicken	1102	1102
red meat	4896	4896
white rice	**168**	**0**
natural juice	**1307**	**2812**
sodas	**833**	**0**
chocolate	**574**	**0**
dried fruits (apricots)	**0**	**138**
sugar	**92**	**56**
coffee	**483**	**159**
tea	**286**	**101**
Total cost	**28576**	**30297**

*Bolded items are those with a change in cost

In the case of oil, the average price of corn oil in the three communities was about 7000LL for a 4 litre container while a smaller (2.85 litre) bottle of olive oil averaged 12 500LL. Corn oil was also much more widely available and was found in 20 stores compared to the olive oil which was found in only 7 stores. Similarly, low-fat labne (strained yogurt) was more expensive than regular labne and orange juice cost considerably more than soda.

In some cases healthier choices were less expensive, such as the replacement of processed cheese with local white cheese. Replacing chocolate by dried apricots and white rice by burghul were also cost-saving changes though they represent a small part of the total basket cost. Making homemade bread or juice is a cost-cutting, if time-consuming, measure not taken into account in this study.

Finally, the brief market study used for the basket calculation suggests that a relatively high diversity is available on the market in these rural areas, although there are some differences between the communities. It also confirmed that wild plants are virtually inexistent in markets of the communities.

Conclusion

The present research is connected to a larger research project, *Wild Edible Plants: Promoting Dietary Diversity in Poor Communities of Lebanon*, the objective of which is the improvement of the health status of the rural and urban poor through the promotion of the preservation and sustainable use of wild plants at the national and regional levels.

Several major limitations of the research undertaken should be noted:

First, the interdisciplinary nature of the topic chosen made it impossible to do an in-depth study in any one area and led to a superficial treatment of certain topics which ideally would have been better explored. Examples include intra-household relationships and food security; indigenous knowledge of wild edible plants and further econometric analysis using models other than logistic regression.

Second, several issues related to the sample and data collection limited the work. Restricting the sample to respondents aged 40 to 60 made analysis of factors related to age virtually impossible. Timing and resource issues precluded use of urban cases as a comparison to rural ones and also restricted use of nutritional data principally to results of the food frequently questionnaire. The agricultural information was impossible to analyse with any depth, both because of the small sample size and because the interviewers were trained with a nutritional focus and had limited ability to elicit valid information about farming methods and data.

Finally, the paucity of information about Lebanon in several fields limited the potential for contextualising results. This was noted, for example, with nutritional information (absence of countrywide consumption studies) as well as income/expenditure data (absence of poverty line calculations) and health studies (no baseline studies on cardiovascular disease available).

Research for the thesis focussed on analysing certain socio-economic dimensions of the question in the rural communities, hinging on three interrelated hypotheses. A summary of findings of each of the hypotheses is presented below, including discussion of some of the

linkages between them and recommendations for both future research and changes to government policy.

More dietary diversity and higher rates of self-produced and self-gathered food are associated with greater food security.

Results of our exploratory study find quantitative food security rates in these rural Lebanese communities similar to those in the United States, with nearly one-fifth of respondents answering affirmatively to one of the food security questions and 5.6% having skipped a meal during the past year for lack of food or money to buy more. Among those who foresaw not having enough food for their next meals, reducing variety and collecting or growing their own food were listed as important strategies.

Diets in the communities were found to be relatively diverse, though with a heavy reliance on white bread, sweetened tea and coffee. Both cross-tabulation and regressions of dietary diversity with food security status revealed a negative relationship of food security with dietary diversity when measured by number of food groups. However, dietary diversity measured by total food item score did not provide the expected results and merits further research. Of particular interest is the possibility that people who are more food secure actually reduce the diversity of total items in their diet - though not the number of food groups from which they eat - possibly because they practice the Lebanese tradition of 'mouneh' reserves of staples. The results of food group analysis also revealed that adding more types of both meats and oils significantly decreased the odds of being food insecure, while the more wild edible plants consumed, the greater the likelihood respondents had of being food insecure.

Wild edible plant collection is widespread in the communities and while nearly two-thirds of respondents reported collecting WEPs, although many collect relatively infrequently. Results from cross-tabulation, correlation and regression indicate that those who collect WEPs are more likely to be food insecure than those who do not, reflecting the endogenous nature of WEP collection and food insecurity. While it may indeed be that collection provides some protection against food insecurity, the fact that people who experience food insecurity tend to collect wild edible plants overshadows the 'protective' element.

While promotion of dietary diversity, when defined by food groups rather than food items, has been shown to be correlated with food security, we have not shown the direction of causality. Likewise while collection of wild edible plants is clearly related to food insecurity, it is not possible to make normative statements about consumption of the plants as a strategy to avoid food insecurity. Even should this causality be proved or assumed, unbridled promotion of wild edible plant consumption as a way to improve the diet is not advised, given that many popular plants are being depleted in the wild.

Results on self-production of food suggest that these rural communities are in fact relatively urbanized with only one-third of residents producing any food and of those who do, less than half selling any of their production. Self-production of food did not seem to have a significant correlation with food security and it was found that compared to those who don't produce food, people who produce for low values are nearly three times more likely to be food insecure, while higher production values had no significant relationship with food security.

Healthier, diverse diets are within the economic reach of people in these communities

Comparison of nutrient analysis of the normal basket suggests that diets in our communities are already adequate, as the normal basket nearly reaches or exceeds the average Dietary Reference Intake for this age group in all categories of nutrient content except calories, of which it has a lower level. It is clear that the healthy basket has a healthier profile than the normal basket, with substantially lower levels of saturated fat and higher levels of dietary fibre, vitamin B12, folate, vitamin C, iron, magnesium, zinc and calcium. Calories are slightly higher than in the normal basket, but still lower than the DRI. Overall, it seems that small changes in the basket can make important nutritional improvements for a relatively small price difference.

The average price difference between the two baskets was roughly 1700 LL (1.7 Canadian dollars) per week, per household, representing a cost increase of 5.6% over the normal basket. A few individual items including bread (wheat or white) and oil are responsible for much of the difference and can seem large. Some of the replacements made to create a healthy basket, such as substituting 100% juice for soda, made it more expensive. Other

replacements, such as such as choosing chocolate instead of apricots, represented cost savings. Further savings could be had by increasing the homemade items of the diet (fresh-squeezed orange juice, homemade bread) but were not included in the healthy basket as they also would involve substantially more preparation time. Thus to the extent that they are already able to afford what they eat, people in these communities do overall have physical and economic access to healthy and diverse diets

A government policy focus on quantitative food security may be compromising qualitative food security

The review of food production and trade policies in Lebanon revealed that in general, policies are:

a) severely limited in scope due to restricted funding, often depending on aid from other countries or international institutions, and frequently plagued by a general lack ability or will to implement laws and regulations;

b) almost totally uncoordinated between different sectors; and

c) to the extent that food policies exist, focused on quantity over quality. Examples of this include the price ceiling on white bread only (and not whole wheat bread); the support, via millers and consumers, for wheat production without regard for biodiversity; and the increasing openness of the food market to foreign imports, notably for cheap unhealthy oils.

Current Lebanese government policies allowing for the import of cheap unhealthy oils to the detriment of healthy local ones as well as processed foods such as white flour to the detriment of local whole grains, do indeed promote food quantity over food quality. Nutritional recommendations for reducing obesity, including consumption of lesser amounts of higher quality fats and more of high-fibre items such as whole grains, direct consumers in one direction while government policy leads them the other. Consumption focused on food quantity rather than food quality may indeed help people avoid situations of hunger, but in the long run it is clear that avoiding quantitative food insecurity is not enough.

Further exploration of this issue will require analysis of both quantitative and qualitative food security. Time-series data from the communities would also provide substantial insights impossible to glean from a one-time study. Recommendations for government policy change can, however, be made on the basis of the wider body of scientific evidence about the importance for human nutrition of diverse diets and consumption of whole grains and varied fruits and vegetables, including wild edible plants as a valuable local source of micronutrients.

Policy recommendations

The current political situation in Lebanon is such that issues including biodiversity and diet are a low priority for the government. However, the paucity of funds for agriculture and environment can also be seen as an opportunity to develop a sustainable food system from the ground up, such that it responds to environmental and social needs, supports economic development which sustains the environment and provides long term food security. Two suggestions for fundamental or structural change are as follows:

> -creation of a program to strengthen the government's ability to implement laws and regulations, including follow-up and evaluation, and increase cooperation between various ministries and institutions
> - development of a cross-sectoral food policy , including nutritional, agricultural and environmental perspectives, with mechanisms for implementation and evaluation including an annual Green Book to document changes and status of agricultural biodiversity including wild edible plants.

Without claiming to propose a complete or in-depth program for change, it is nevertheless useful to highlight types of agricultural and trade policy change which can address some of the issues addressed in this research.

A large portion of Lebanese government funds (and private subsidization, in the case of wheat) which are attributed to agriculture go to the specific crops of wheat, sugar and tobacco. The fact that there are no specific criteria for eligibility for these subsidies indicates that they are not part of an overall strategy for agricultural development, without solid justification for favouring the subsidized crops over others. The price supports also do not particularly encourage farmers to invest in the productive capacities of their farms but act instead as short term solutions to a problem.

While there is clearly a societal cost to price support programs, whether it be government expenses or increased costs to transformers or consumers, a certain loss of economic efficiency may be a reasonable price to pay for transferring income to the rural poor or creating greater food self-sufficiency, should those be societal priorities. However, a decision to provide price supports should be made in the context of a broader agricultural policy and evaluated to ensure that the targeted crops are economically, socially or environmentally logical ones. If subsidies to specific crops were lifted, the budgets thereby freed could be transferred to other priorities such as distribution of a wide range of species and varieties of seeds, better training for farmers including biodiversity conservation and organic agriculture practices or agricultural support using a multifunctional model. Suggestions for such potential policies, at different points of the food system, include:

Food production:

-Replace wheat and sugar beet subsidy with support for farming that satisfies ecological, nutritional and economic criteria, along a multifunctional model
-Support cultivation of popular wild edible plants which are endangered
-Encourage cultivation of neglected and underutilized plants, including a wide range of species and varieties in subsidized seed production programs
-include nutritional characteristics in seed dissemination programs
-Support production of healthy oil (olive) for national consumption, possibly using supply management model

Food trade:

-Tax / restrict imports of certain unhealthy foods including unhealthy oils
-Negotiate, in coalition with other governments, alternative aid to wheat dumping programs

Food processing:

-Standardize low fat / lean labels
-Support development of traditional healthy food processors

Food consumption:

-Provide fat descriptor information on food label
-Develop dietary guidelines and implement
-Promotion of food guide, food pyramid, dietary diversity
-Develop stricter standards for any food under government control (public schools…)
-Restrict or tax advertising for unhealthy foods
-Require tobacco-style warnings for fats
-Remove price ceiling on white bread and place ceiling on whole wheat bread

Our contention has been that the dietary changes occurring in Lebanon and their attendant health impacts are not simply the effect of personal choices but are also influenced by government policy. Further research into impact of policies at different levels of government within countries as well as internationally, is urgently needed to counter food insecurity in its broadest sense, including diseases stemming from both nutrient deficiencies and over consumption of unhealthy foods.

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Appendix 1 : General Survey

AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF AGRICULTURE AND FOOD SCIENCES

Wild Edible Plants: Promoting Dietary Diversity in Poor Communities of Lebanon

I. Name of interviewer:	
II. Gender of interviewer:	□Male □Female
III. Time interview started:	_____ AM/PM (please circle one)
IV. Date of interview:	_____/_____/_____ Day Month Year
V. Case #:	☐☐ ☐☐ ☐☐☐ ☐☐ ☐☐☐ Interviewer Area House Gender Interviewee
VI. Name:	First: Last: Father:

(It is preferable to take the measurements after completion of the questionnaire)

<table>
<tr><td>MEA1</td><td>Measures</td><td>1. Weight (Kg): _____
2. Height (m): _____</td><td>3. Waist circumference (cm): _____
4. Body fat (%): _____</td></tr>
<tr><td>MEA2</td><td>Blood profile</td><td colspan="2"><table><tr><td></td><td>Result</td></tr><tr><td>1. Cholesterol (mg/dl)</td><td></td></tr><tr><td>2. Triglycerides (mg/dl)</td><td></td></tr><tr><td>3. Glucose level (mg/dl)</td><td></td></tr></table></td></tr>
<tr><td>MEA3</td><td>Blood pressure</td><td colspan="2"><table><tr><td>1. Systolic blood pressure</td><td>2. Diastolic blood pressure</td></tr><tr><td></td><td></td></tr></table></td></tr>
</table>

General information

Number	Question	Answer
GEN1	Gender	1. Male 2. Female 2a.If you were a female, did you enter menopause? 1. Yes 2. No
GEN2	Date of birth	_______________ day month year
GEN3	Relation with the head of the household:	1. Spouse 2. Parent 3. Brother/sister 4. Head of the household 5. Child 6. Grandparent 7. Other relative 8. Other non relative, specify,_____
GEN4	Place of birth	1. Village: _____ 2. Mouhafazah: _____ 3. Country:_____ 4. Kadaa: _____
GEN5	Place of residence	1. Kadaa: _____ 2. Village: _____ 3. Mouhafazah:_____
GEN6	Marital status. Please specify the number of years	

√	**Marital status**	**Number of years of marriage**	**Number of living sons**	**Number of living daughters**
	1. Never married			
	2. Married			
	3. Separated			
	4. Divorced			
	5. Widowed			

GEN7	Present occupation	1. Farmer 2. Employee (blue collar) 3. Unemployed (looking for a job)	4. Employee (white collar) 5. Self employed (specify):_____ ___ 6. Unemployed (not looking for a job)	7. Homemaker 8. Student	9. Retired 10. Other, specify: _____
GEN8	Number of <u>hours</u> spent daily at work 1 2 3 4 5 6 7 8 9 more NA				
GEN9	Number of working days per week (if applicable) 1 2 3 4 5 6 7 NA				
GEN10	Educational level	1. Illiterate 2. Reads and writes 3. Primary school	4. Intermediate 5. Secondary	6. University 7. Technical/vocational	
GEN11	Number of people living in the household: _____				
GEN12	Number of children under 15 living in the household: _____				
GEN13	Number of rooms in the house (excluding kitchen and bathrooms): _____				
GEN14	Is the house…	1. Owned	2. Rented	3. Other: _____.	

Health status

HEA1	Have you been diagnosed with one of the following chronic diseases?	

Chronic disease	Yes/No	Date of diagonosis (year)	Check if cured
Diabetes			
Hypertension			
CVD			
Cholesterol			
High triglycerides			
Cancer			
Osteoporosis			
Goiter			
Anemia			
Other chronic diseases			

HEA2	Has any member of your family been diagnosed with the following diseases?	

	Yes/ No	Relation (mother/ father,…)	Date of diagnosis (year)
Diabetes			
Hypertension			
CVD			
Cholesterol			
High triglycerides			
Cancer			
Osteoporosis			
Other chronic diseases			

<table>
<tr>
<td>HEA3</td>
<td>Do you currently smoke?</td>
<td>1. Yes
a. If Yes, # cigarettes per day? _____
b. If Yes, # years you smoked? _____</td>
<td>2. No
a. If No, were you a previous smoker?
i. Yes
1. If Yes, # years you smoked? ____
2. If yes, # cigarettes per day? _____
ii. No</td>
</tr>
<tr>
<td>HEA4</td>
<td>Do you smoke the narguileh</td>
<td>3. Yes
a. If yes, # minutes per day? _____
b. If Yes, # years you smoked? _____</td>
<td>4. No
a. If No, were you a previous narguileh smoker?
i. Yes
1. If yes, # years? ____
2. If yes, # minutes per day?_____
ii. No</td>
</tr>
<tr>
<td>HEA5</td>
<td>Number of hours spent watching TV per day? (√):</td>
<td colspan="2">
<table>
<tr><td>1</td><td>Do not watch TV</td><td></td></tr>
<tr><td>2</td><td>Less than an hour</td><td></td></tr>
<tr><td>3</td><td>1-3 hours</td><td></td></tr>
<tr><td>4</td><td>3-5 hours</td><td></td></tr>
<tr><td>5</td><td>More than 5 hours</td><td></td></tr>
</table>
</td>
</tr>
</table>

HEA6 Number of hours per day spent on computer playing games or working? (√)

1	Do not use the computer	
2	Less than an hour	
3	1-3 hours	
4	3-5 hours	
5	More than 5 hours	

HEA7 Physical activity: Please specify the type of physical activity you usually do.

Type of physical activity		Number of times				Period of time			
	√	#year	#month	#week	#day	Less than 30 min	3060 min	1-1.5 hrs	More than an hour
Walking and hiking									
Jogging- running									
House work (house-cleaning...)									
Gardening or farmwork									
Group sports (football, basketball, volleyball, other…)									
Individual exercise (swimming, dancing, aerobics, other…)									
Other, specify:									

HEA8 On a scale of 1 to 10 how do you rate your level of stress in everyday life (10 being the most stressful and 1 being least stressful)

_____

HEA9 On a scale of 1 to 10 how do you rate your level of happiness in everyday life (10 being the least happy and 1 being most happy)_____

Income: We would like to ask a few questions concerning about the source of income for your household for the past year

INC1	Overall, what was your family's total income in the past year (including in- kind gifts)	-less than 3600 000 LBP (300 000 LBP per month) - 3 600 000 – 9 600 000 (300 000 – 800 000 / month) - 9 600 000 – 19.2 million (800 000 – 1.6 million / month) - 19.2 million – 38.4 million (1.6 million – 3.2 million - more than 38.4 million (more than 3.2 million/ month)

1. Yes, did have income 2. No, did not have income	8 . DK 9 . No answer	Net income (LBP), specify M for monthly income, Y for yearly income.

Did you have a regular income...

INC2	….from wages, salary?	1 2 8 9	
INC3	....from the government?	1 2 8 9	
INC4	....from associations (religious, private,…)?	1 2 8 9	
INC5	....from scholarships or retirement funds?	1 2 8 9	

Do you have an income from private work (or self- employment)?

INC6	Income from self-employment such as plumbing, carpentry, forgery painting, housecleaning, childcare, street vending of cigarettes or lottery coupons , cab driving, or any other similar work for cash or in- kind payments	1 2 8 9	
INC7	Income from sale of agricultural goods such as eggs, meat or vegetables	1 2 8 9	

Did you get money gifts or gifts in- kind (food, clothes, books, applicances...)																
INC8	.... from relatives and friends ?	1	2	8	9											
INC9	.... from an employer?	1	2	8	9											
INC10	.... from the government (municipal help with renovation...)?	1	2	8	9											
INC11	.... from associations?	1	2	8	9											
	If any of these gifts are food, please specify which foods:															
Other income																
INC12	Other sources of income • Renting of land or house or any other property	1	2	8	9											
	• Money interest from bank or savings	1	2	8	9											
	• Investment	1	2	8	9											
	• Grant insurance payments or compensation for damages	1	2	8	9											
	• Alimony	1	2	8	9											
	• Sale of material assets (cars, jewelry, clothes, furniture)	1	2	8	9											
Economic self evaluation																
INC13	Generally speaking, how do you regard your household's economic situation in relation to people who live in Lebanon?	1. We are among the **rich** in Lebanon 2. We are not rich, enough to live well 3. We are **middle class** neither rich nor poor 4. We are **poor**														

INC14	If your household had a sudden need for 150,000 LBP, would you be able to raise the money in a week?	1. Yes, would resort to my savings 2. Yes, with some help from others 3. Yes, by taking an advance on my salary	4. Yes, we would sell our belongings 5. No, impossible 6. DK 7. NA
INC15	If the answer is No or Maybe, since when has the economic situation of your household been so difficult?	1. More than 5 years or always 2. Last 2-5 years 3. Last 2 years 4. Last year	5. Situation not difficult 6. DK 7. NA
INC16	If your situation remains the same, what is the least amount of net monthly income that your household needs for living?	8 9	_____LBP
INC17	I am going to read a list of items. For each, please tell me whether your household has such items		

Kind	Yes	No	Number
1. Bicycle			
2. Refrigerator			
3. Electric or gas stove (cooking)			
4. Kerosene, diesel or wood oven (heating)			
5. Electric fan			
6. Washing machine (for clothes)			
7. Vacuum cleaner			
8. Sewing machine			
9. Motorbike			
10. Car or truck			

Kind	Yes	No	Number
11. Tractor			
12. DVD player			
13. Air conditioner			
14. Personal computer			
15. Radio cassette player			
16. Electric blender			
17. Television set			
18. Satellite dish (or membership)			
19. Photo camera			
20. Video camera			
21. Mobile phone			
22. Landline			
23. Video recorder			

INC18	Could you please estimate your monthly expenditures for the following items (Lebanese Liras L.L.)?	1. Food eaten at home	
		2. Food eaten outside the home	
		3. Rent	
		4. Electricity	
		5. Landline	
		6. Mazout, oil, charcoal (for heating)	
		7. Household items + personals (soap, detergents,…)	
		8. Entertainment	
		9. Cellular phone	
		10. Gas (for the car, motorcycle,…) and transport	
		11. Education (school, institution, university)	
		12. Payments on loans	
		13. Water	
		14. Furniture and housekeeping	
		15. Healthcare	
		16. Clothes and shoes	
		17. Other (tobacco?)	

Food security FS			
FS1	Which of these sentences applies the most to the food eaten by your family during the past 12 months?	1. We had enough to eat of the kinds of food we wanted (quantity and quality) 2. We had enough to eat but not always the kinds of food we wanted (only quantity) 3. Sometimes we did not have enough to eat (quantity) 4. Often we did not have enough to eat 5. DK/NA 6. Other, specify:_____	
I'm going to read two statements that people have made about their food situation. Tell me whether the statement was often, sometimes or never true for you.			
FS2	"In the past 12 months the food we bought did not last and we did not have enough money to buy more of it"	1. Often true 2. Sometimes true	3. Never true 4. DK/NA
FS3	"In the past 12 months we could not afford to eat healthy balanced meals"	1. Often true 2. Sometimes true	3. Never true 4. DK/NA
FS4	In the past 12 months, did you or any member of your family skip a normal daily meal because you did not have enough food or money to buy food?	1. Yes, almost every month 2. Yes, but for only for some months	3. Only for one or two months 4. Never
FS5	In the past 12 months, did you or any member of your family not eat for a whole day because there was not enough food or money to buy food?	1. Yes, almost every month 2. Yes, but only for some months	3. Only for one or two months 4. Never
FS6	(If Yes to questions 4 or 5), did you skip a meal in a	1. Yes 2. No	

	specific season?	If Yes, specify during which season: 1. Summer 2. Fall 3. Winter 4. Spring
FS7	(If Yes to questions 4 or 5), did you skip a meal during a particular time of the month?	1. Yes 2. No If Yes, specify which time of the month 1. Beginning of the month 2. Middle of the month 3. End of the month
FS8	Did you ever foresee not having enough food for the next meal or for next day because of lack of money? (If more than one answer is chosen, all strategies used and which you relied on most and second most …)	1. Almost every month 2. Yes, but only some months 3. Only for one or two months 4. Never

If Yes, how did you cope	Check all that apply	Relied on most	Relied on second most
1. Ate less quantity of food			
2. Substituted less expensive foods for normally eaten foods			
3. Reduced the variety of foods			
4. Collected food from wild or garden			
5. Asked for help from family, neighbors and friends			
6. Worked more to obtain money for food			
7. Sold assets to obtain money for food			
8. Other, specify: _____			

FS9	Do you ever reduce the quantity of food you eat in order to have more for other members of the household?	1. Yes, almost every month 2. Yes, but only some months 3. Only during one or two months 4. Never	To whose benefit? (check all that apply) 1. Spouse 2. Children 3. Other
FS10	How do you feel about the food in your house?	1.It is exactly what I want to eat 2.We do not eat enough of some foods (identify which foods)_____ 3.We eat too much of some foods (identify which foods) _____	
	For the previous question, categorize the foods. For example, grains, meat, dairy, fruits, vegetables, processed foods, fast foods…		

Nutritional habits

DIE 1- 24 hour recall

List the food items consumed during the past 24 hours specifying the type, amount and timing.

Type of food	Amount	Time	Remarks and Ingredients for mixed dishes

Do the food items previously stated correspond to your normal eating pattern?

1. Yes 2. No

If No, why?

(If more space is needed, use the other side of the paper)

DIE 2 How frequently do you consume these foods? Food frequency questionnaire

type of food	amount	Seasonal?	number of times				source		
			# day	**# week**	**# month**	**# year**	**Buy it from store**	**Buy it directly from producer**	**Grow or produce it**
1. Breads and cereals									
1.1. Bread (whole wheat)									
1.2. Bread (white)									
1.3. Burghol									
1.4. Corn									
1.5. Rice (white)									
1.6. Pasta									
1.7. Cooked wheat									
2. Fruits									
2.1. Apples									
2.2. Bananas									
2.3. Grapes									
2.4. Citrus fruits (Oranges, …)									
2.5. Persimmon									
2.6. Apricots									
2.7. Melons									
2.8. Plum									
2.9. Water melon									
2.10. Green plum									
2.11. Cherries									
2.12. Strawberries									
2.13. Raspberries									
2.14. Pears									
2.15. Greenalmonds									

type of food	*amount*	*Seasonal ?*	*number of times*				*source*		
			# day	**# week**	**# month**	**# year**	**Buy it from store**	**Buy it directly from producer**	**Grow or produce it**
2.16. Other fruits									
3. Vegetables									
3.1. Cucumbers									
3.2. Tomatoes									
3.3. Lettuce									
3.4. Cabbages									
3.5. Mint									
3.6. Green beans									
3.7. Squash									
3.8. Eggplant									
3.9. Green peas									
3.10. Cauliflower									
3.11. Rocket leaves									
3.12. Watercress									
3.13. Spinach									
3.14. Radish									
3.15. Beet/turnip									
3.16. Garlic									
3.17. Onion									
3.18. Potatoes									
3.19. Wild cucumber									
3.20. Broad beans									
3.21. Parsley									
3.22. Tomato sauce									
4. Other vegetables									

type of food	*amount*	*Seasonal?*	*number of times*				*source*		
			# day	**# week**	**# month**	**# year**	**Buy it from store**	**Buy it directly from producer**	**Grow or produce it**
5. Legumes									
5.1. Lentils									
5.2. Fava beans									
5.3. Chickpeas									
5.4. Kidney beans									
5.5. other legumes									
6. Milk and dairy products									
6.1. Whole milk (please specify source: cow, goat…)									
6.2. Whole yoghurt									
6.3. Whole labneh									
6.4. Cheese (all kinds including the processed cheeses)									
6.5. Kicheck									
6.6. Shanklish									
6.7. Kachta									
6.8. Cooked yoghurt									
6.9. Rice with milk/mouhallabiah									
7. Meats									
7.1. Red meat									
7.2. Chicken									
7.3. Fish									
7.4. Organ meats									
7.5. Seafood									

type of food	*amount*	*Seasonal?*	*number of times*				*source*		
			# day	**# week**	**# month**	**# year**	**Buy it from store**	**Buy it directly from producer**	**Grow or produce it**
7.6. Birds									
7.7. Other wild animals:									
8. Fats and oils									
8.1. Olive oil									
8.2. Vegetable oil									
8.3. Margarine									
8.4. Ghee									
8.5. Butter									
9. Drinks									
9.1. Natural juice (100% fresh)									
9.2. Sodas/carbonated beverages									
9.3. Sweetened juices (Bonjus, tang)									
9.4. Tea									
9.5. Coffee									
9.6. Herbal tea (specify)									
9.7. Alcohol (specify)									
9.8. Other drinks									
10. Other									
10.1 Oriental pastry									
10.2 Foreign pastry									
10.3 Mixed nuts									
10.4 Chocolate									

type of food	amount	Seasonal?	number of times				source		
			# day	**# week**	**# month**	**# year**	**Buy it from store**	**Buy it directly from producer**	**Grow or produce it**
11 Wild edible plants									
11.1 Chicory (Hindbeh)									
11.2 Mallow (Khebbayseh)									
11.3 Mokho bi Ebbo									
11.4 Rocket leaves (Jarjeer)									
11.5 Pale star thistle (Dardarieh)									
11.6 Thyme									
11.7 Eryngo (Qursaaneh)									
11.8 Purslane (Bakle)									
11.9 Other WEP									
12 Wild fruits									
12.1 Hawthorn(Zaarour)									
12.2 Wild pears									
12.3 Blackberry(Alleyk)									
12.4 Myrtle (Hinblass)									
12.5 Barberry (Barbariss)									
12.6 Wild almonds									
12.7 Wild prunes									
12.8 Mastic Tree (Shaashoub)									
12.9 Prickly pear									
12.10 Other wild fruits									

2. No 1. Yes Specify	Do you usually collect Wild Edible Plants?	***DIE3***
Feb | Mar | April | May | June | July	Yes, when do you collect these plants	
1 2 3 4 5 6 7 9 10 More than 10	How many times per season do you collect WEP? (√)	
Consume them — Percentage (added up to equal 100%) Give to others (family, friends, neighbors,…) Sell	What do you do with the plants?	
	Can you estimate the market value of what you collect during the season?	
1. No 2. Yes Specify the kind _____ What do you do with it? Consumption — Percentage (total amount grow 100%) Gifts to others (family, friends, neighbors,…) Sell	Do you produce any kind of food (plants, eggs, meat, milk...)?	***DIE4***
	Can you estimate the market value of what you grow during the season?	

<table>
<tr><td>5. From expert in village
6. From school/ university
7. Other (specify):_____
8. Not applicable</td><td>1. From my parents
2. From my grandparents
3. From my siblings
4. From extended family members</td><td>How did you learn about WEP (collection, growing and information)? (√)</td><td>DIE5</td></tr>
<tr><td colspan="2">1. Yes 2. No 3. NA</td><td>Do your children know about the collection and growing of wild edible plants?</td><td rowspan="2">DIE6</td></tr>
<tr><td colspan="2"><table><tr><td>1.</td><td>Lack of time</td><td></td></tr><tr><td>2.</td><td>Lack of interest</td><td></td></tr><tr><td>3.</td><td>Does not know</td><td></td></tr><tr><td>4.</td><td>Other</td><td></td></tr></table></td><td>If No, why not? (√)</td></tr>
<tr><td colspan="2"></td><td>What, in your opinion, are the benefits of wild edible plants?</td><td>DIE7</td></tr>
</table>

DIE8	How much salt do you usually add to your food? (√)	1. Not at all 2. Only in cooking- small amounts	3. In cooking and on the table 4. In cooking and on the table- large quantities
DIE9	Do you usually use broth cubes?	1. Yes	2. No
DIE10	Are you taking any vitamin/mineral supplements?	1. Yes If, yes: Kind: _____ # pills per day: # pills per week:	2. No
DIE 11	Are you taking any medication?	2. Yes If, yes: Kind: _____ # pills per day: # pills per week:	2. No
END	Comments		
	Time the interview ended:	_____ AM/PM (please circle one)	
	Total approximate time of interview	_____ minutes	

Appendix 2: Agricultural Production Survey

AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF AGRICULTURE AND FOOD SCIENCES

Wild Edible Plants: Promoting Dietary Diversity in Poor Communities of Lebanon

VII. Name of interviewer:	
VIII. Gender of interviewer:	□Male □Female
IX. Time interview started:	_____ AM/PM (please circle one)
X. Date of interview:	_____/_____/_____ Day Month Year
XI. Case #:	Interviewer Area House Gender Interviewee
XII. Name:	First: Last: Father:

DIE3a	*Do you hunt or raise animals?*			***1. No Skip to number 5***		***2. Yes Continue***	
				Animal 1	Animal 2	Animal 3	Animal 4
What animals do you raise or hunt?							
Hunt							
Raise							
What is the annual number of the animals you raise or hunt?	Number per year						
Approximately, how many hours/days you spend tending to them?	Labor (days/hours)	Yourself					
		Family					
		Worker					
What is the additional cost of raising or hunting animals? (if available)	Additional cost (health care, shelter, slaughter…)						
Where do you get the small animals from? (i.e.chicks,veal)	Storage	Yourself					
		From the neighbor (cost/ L.L.)					

and what is their cost?		Buying (cost/L.L.)					
DIE3b	Do you cultivate or collect any plants?			**1. No Skip to number 6**		**2. Yes Continue**	
				Plant 1	Plant 2	Plant 3	Plant 4
Plant							
What is the land area used for cultivating plants?	Land area (m^2)						
What is the annual outcome?	Outcome (kg or tons)						
Approximately, how many hours/days you, your workers or your family spend on collecting or tending to them?	Labor (days/hours)	Yourself					
		Family					
		Worker					
Do you use pesticides? If yes, what is amount and price?	pesticides	Quantity (L.)					
		Price (L.L.)					

Do you use fertilizers (chemical or natural)? If yes, what is amount and price?	Fertilizers	Natural (quantity/LL.)					
		Price (L.L.)					
		Chemical (quantity/L.)					
		Price (L.L.)					
Where do you get the seeds from? In case you buy them, what is their secondary cost?	seeds	Yourself					
		Neighbors (cost/L.L.)					
		Buy (cost/L.L.)					
	Additional costs						

END	Comments	
	Time the interview ended:	_____ AM/PM (please circle one)
	Total approximate time of interview	_____ minutes

Appendix 3: Total weekly in-season food group consumption score

N	*Valid*	*798*
	Missing	0
Mean		6.534
Std. Error of Mean		.0354
Median		7.000
Mode		6.0
Std. Deviation		.9997
Variance		.999
Skewness		-1.411
Std. Error of Skewness		.087
Kurtosis		7.208
Std. Error of Kurtosis		.173
Range		8.0
Minimum		.0
Maximum		8.0
Sum		5214.0

Appendix 4: Daily equivalent scores for food items

Food item	**Daily equivalence score** (ranked in descending order)
coffee	1.52
white bread	1.49
tea	1.36
tomatoes	0.91
whole labneh (soft cheese)	0.84
cucumbers	0.80
wheat bread	0.74
cheese	0.60
wild onions	0.57
whole laban (yogurt)	0.54
vegetable oil	0.54
garlic	0.50
olive oil	0.45
potatoes	0.41
cucumbers	0.39
figs	0.37
mint	0.36
mixed nuts	0.34
margarine	0.30
whole milk	0.30
lettuce	0.30
broad beans	0.29
sodas	0.27
parsley	0.27
radish	0.27
almonds	0.26
red meat	0.26
white rice	0.25
natural juice	0.24
tomato paste	0.23
chicken	0.19
chocolate	0.15
eggplant	0.15
kicheck (bulgur and goat milk based powder)	0.15
Hindbeh (Chicory)	0.14
burghol (bulgur)	0.14
fava beans	0.12
cabbages	0.12
chickpeas	0.11
bakleh (WEP) (purslane)	0.11
thyme	0.11
beans	0.11
shanklish (fermented cheese)	0.11
oriental pastry	0.10

butter	0.10
lentils	0.10
cooked laban (yogurt)	0.10
foreign pastry	0.10
cauliflower	0.09
zucchini	0.09
cress (WEP)	0.08
sweetened juice	0.07
kachta (cream)	0.07
orsanneh (WEP) (eryngo)	0.07
rocca (arigula)	0.06
spinach	0.05
pasta	0.05
kidney beans	0.05
khebbayseh (WEP) (mallow)	0.05
mouhallabiah (milk pudding)	0.05
fish	0.04
beet/ turnip	0.04
green peas	0.04
corn	0.03
ghee (clarified butter)	0.03
organ meats	0.02
zaarour (WEP) (wild berry)	0.01
cooked wheat	0.01
pears	0.01
wild birds	0.01
wild almonds	0.01
wild prunes	0.01

*all other items received a score of less than 0.01 and are not reported

Appendix 5: Correlation food security with income and wealth

Food Security – Income Correlation

			Number quantitative food security questions answered yes	Total income (INC2M to 12.6M)
Kendall's tau_b	Number quantitative food security questions answered yes	Correlation Coefficient	1.000	-.240(**)
		Sig. (2-tailed)	.	.000
		N*	381	346
	Total income (INC2M to 12.6M)	Correlation Coefficient	-.240(**)	1.000
		Sig. (2-tailed)	.000	.
		N*	346	346
Spearman's rho	Number quantitative food security questions answered yes	Correlation Coefficient	1.000	-.299(**)
		Sig. (2-tailed)	.	.000
		N*	381	346
	Total income (INC2M to 12.6M)	Correlation Coefficient	-.299(**)	1.000
		Sig. (2-tailed)	.000	.
		N*	346	346

** Correlation is significant at the 0.01 level (2-tailed).

* only women were used for this correlation

Food Security – Wealth Index Correlation

			Number quantitative food security questions answered yes	Items ownership scale
Kendall's tau_b	Number quantitative food security questions answered yes	Correlation Coefficient	1.000	-.142(**)
		Sig. (2-tailed)	.	.001
		N*	381	375
	Items ownership scale	Correlation Coefficient	-.142(**)	1.000
		Sig. (2-tailed)	.001	.
		N*	375	375
Spearman's rho	Number quantitative food security questions answered yes	Correlation Coefficient	1.000	-.179(**)
		Sig. (2-tailed)	.	.001
		N*	381	375
	Items ownership scale	Correlation Coefficient	-.179(**)	1.000
		Sig. (2-tailed)	.001	.
		N*	375	375

** Correlation is significant at the 0.01 level (2-tailed).
*only women were used for this correlation.

Appendix 6: Logistic Regressions on Food Insecurity with and without income variable

WITHOUT INCOME VARIABLE						
	B	S.E.	Wald	df	Sig.	Exp(B)
WEP collection (no collection omitted)						
lowWEPcollection	1.531	0.473	10.481	1	0.001	4.623
highWEPcoll	1.703	0.461	13.666	1	0	5.493
Dietary diversity: number of food groups consumed from weekly (0=6-8 groups)						
fivelessgps	1.676	0.34	24.252	1	0	5.346
Education (illiterate omitted)						
loweduDUM	0.006	0.409	0	1	0.988	1.006
mededuDUM	0.766	0.37	4.283	1	0.038	2.15
higheduDUM	0.338	0.826	0.167	1	0.682	1.402
Employment (0=unemployed)						
employedDUM	-0.432	0.434	0.994	1	0.319	0.649
Constant	-3.44	0.508	45.879	1	0	0.032

WITH INCOME VARIABLE						
	B	S.E.	Wald	df	Sig.	Exp(B)
WEP collection (no collection omitted)						
lowWEPcoll	1.587	0.49	10.492	1	0.001	4.891
highWEPcoll	1.567	0.474	10.942	1	0.001	4.794
Dietary diversity: number of food groups consumed from weekly (0=6-8 groups)						
fivelessgps	1.413	0.356	15.794	1	0	4.109
Education (illiterate omitted)						
loweduDUM	0.187	0.427	0.191	1	0.662	1.205
mededuDUM	1.222	0.408	8.961	1	0.003	3.394
higheduDUM	1.101	0.94	1.373	1	0.241	3.007
Employment (0=unemployed)						
employedDUM	-0.619	0.68	0.829	1	0.362	0.538
Income (very low income omitted)						
lowINC	-1.116	0.382	8.52	1	0.004	0.328
medINC	-1.832	0.459	15.931	1	0	0.16
medhighINC	-1.807	1.107	2.665	1	0.103	0.164
Constant	-2.564	0.53	23.41	1	0	0.077