

Micronutrients and urban life-style: lessons from Guatemala

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SUMMARY. Micronutrients and urban life-style: lessons from Guatemala. Guatemala is a nation of 10 million persons, at the northern point of the chain of five Republics derived from Spanish colonies on the Isthmus of Central America. The country is diverse in its ethnicities, its climate and terrain, and its agricultural pursuits. The majority of its population is poor, illiterate, and under-employed. It has had a unique and turbulent political history, and only recently has emerged. The traditional basis of the diet, dating to Mayan times, is maize and beans. Guatemala City, with its population in excess of 2 million inhabitants, having doubled since the Earthquake of 1976, is the only major metropolis. The pattern of dietary selection and the format of eating meals is changing in relationship to the size, congestion, economic evolution, and modernization of the capital city. A wider selection of foods is consumed in the city, but preparation follows the traditions of the rural cuisine. Street vendors play an ever larger role in the feeding of the urban poor. Quantitative data are only available for vitamin A and zinc, and only in certain subsegments of the population. The vitamin A in fortified foods, notably table sugar which is fortified with retinyl palmitate by legal mandate, makes up over one-third of the intake. The maize tortilla is an important source of calcium, iron, zinc and copper. Average zinc intakes are appropriate, but the biological availability of the metal is low. The intake of iodine is totally dependent upon table salt which is inconsistently fortified. Data on micronutrient status exists for vitamin A, iron, iodine, riboflavin and zinc. With respect to rural areas, no major advantages or disadvantages in the adequacy of micronutrient nutrition can be claimed for the urban population. It is probable that, in the metropolitan area, vitamin A nutrition is slightly better and riboflavin status somewhat poorer than in the countryside. The prospects for future directions in urban lifestyle, in micronutrient status and in their interaction are uncertain. The pressures of growth are straining the ability of the municipal infrastructure and the industrial base to respond with provision of services and employment.

INTRODUCTION

The major focus of this meeting is the issue of micronutrients and urban life-style in Brazil, which has a population of 146,000,000 (1992) inhabitants distributed over a country with an area of 8,511,965 km². Guatemala is a nation of 10,000,000 distributed over 108,900 km². Despite the dissimilarities in size and population, one can find a number of superficial similarities between these two nations. For instance, both have extensive rain forest: the Amazon basin in the former and the Peten's Mayan biosphere in the latter. This has placed on them the burden of supporting oxygen-generation for the planet as a whole. Reports of criminal abuse of street children has reached the worldwide syndicated news services from both nations.

In the nutritional area, both countries are nations of beans. Legumes (*feijao*, *frijol*) are the traditional basis of the diets of both countries. Both are multi-ethnic societies. With respect to nutrition research, the countries have a similar important legacy of contributions to the scientific literature and to important investigations in nutritional science. The persistent and aggressive pursuit of knowledge, specifically in the areas of *urban* nutrition and of diet and health, characterize the nutrition communities of both nations.

Dissimilarities and contrasts between the two nations also exist. The partition of urban-to-rural of the present Brazilian population is 73:27. In Guatemala, it is 40:60. As such, within Latin America, Guatemala, along with its Central America neighbors, represents the more rural predominant populations. In fact, the mayors of Sao Paulo and Rio de Janeiro govern more citizens (20 million and 11.8 million, respectively) than the President of Guatemala governs in the Republic as a whole. Guatemala City, the capital with 2 million residents, is the only major metropolis in that Republic.

A PROFILE OF GUATEMALA

Nutritional status of societies is strongly influenced by dietary intake as well as by the physical and biological environment. Social, economic and cultural features give the shape and texture to the interaction of man with his surroundings. The foods available from local production will be determined by factors such as climate, terrain, soil conditions, and native and imported flora and fauna. The geographic and geological position of Guatemala, along with its anthropological and political history are an important backdrop to the analysis of nutrition for any subpopulation within its borders.

The terrain of the Republic is a blend of rain forest, volcanic highlands, arid desert and coastal plain. Guatemala has a tropical climate with rainy and dry seasons equally dividing the calendar. The *Sierra Madre* mountains constitute a continental divide and the northeastern part of the country is under the influence of the Caribbean (Atlantic) tropical weather patterns while the southwestern sector is response to the Pacific pattern.

The Isthmus of Central America has been inhabited for millennia by Amerindian groups common to the MesoAmerican region. The Mayan civilization was established parts of Mexico and Guatemala. Guatemala is a mixture of European (mostly Spanish), African and native Caribbean ethnic groups, but the majority of the population is of post-Mayan indigenous heritage, speaking one of 21 Mayan languages as their first tongue. The first contact with the Spanish came in 1524 with the arrival of the Conquistadors under Pedro Alvarado. Guatemala was the seat of the Spanish colony of Central America until 1821 when they obtained their independence from the Spanish Crown. A Republic emerged thereafter which has had a turbulent political history, with alternating periods of enlightenment and reform and of military dictatorship. On January 29, 1997, a formal peace agreement was signed between the constitutional government and the insurgent groups that had engaged in

a civil was for 36 years. The median household income is \$600 (US) annual. In terms of the ability to satisfy basic household needs, 85% are below the poverty line, and 63% are below the extreme poverty line. On the other hand, half of the arable land is concentrated in the hands of 3% of the population. Guatemala is second only to Haiti in terms of the percentage of the population that cannot read or write the official language, in this case Castellan Spanish. Guatemala, the republic, has a relatively high fertility rate and a doubling time of <25 years. The majority of the population is below 15 years of age.

Most of the population lives in the highlands. Conflict over land and its ownership has existed since the time of the Conquest. There is also conflict over the *use* of land. When placed to commercial export-crop use, coffee is the leading crop, growing well in the highland, volcanic solid. Also grown in the highlands are snow-peas, a non-traditional export crop. Banana's are grown near the Atlantic coast and sugar cane on the Pacific coast. When subsistence and food-crop farming wins out, maize and bean cultivation is the most important. Pumpkins, squashes, orchard fruits, and vegetable are also grown for personal consumption and sale in the local produce market. The livestock include cattle, raised on the coast for meat, and sheep, raised in the highlands for wool.

URBANIZATION IN GUATEMALA

In fact, improvements in transportation and communications during the latter half of the 20th Century be the single most important factor, favoring migration to the capital city. Through the first four and one-half centuries after the Conquest, most of the settlements and plantations (*fincas*) were isolated and accessible over very difficult roads by food or with beasts of burden. The advent of paved highways affected both the rural gentry, who could administer their lands while based in more comfortable capital, and the rural peasantry, who could visit cities with regularity.

Guatemala City had a population of less than 1 million at the beginning of the 1970s. On February 4, 1976 a devastating earthquake with a magnitude of 7.6 on the Richter Scale, shook the country with a cumulative mortality of over 30,000. The majority of these deaths occurred in rural provinces close to the capital. This seismic event set of a chain reaction of demographic events. The population of the city has more than doubled over the next two decades. Part of this came from natural growth, i.e. children born in the capital. Most of it was due to rural-to-urban migration. The great majority of the increases was among the poor.

The central city itself has undergone rapid change. Like most Latin American cities the capital began around a main plaza with the religious center, the Cathedral, and the seat of government. It was earthquakes in 1773 the colonial era that, in fact, had produced the translocation of the capital of the Spanish colony on the Isthmus from it setting at Antigua Guatemala after almost 250 y. From its founding in 1776 through the early part of this Century, this city center (Zona 1) and its contiguous zones were both the residential and commercial heart. The foreign diplomatic embassies were in this downtown sector until the 1970s. After the revolution of 1944 and the counter-revolution of 1954, the wealthier families began to build larger houses and *estates* to the south of the central zones. As tourism grew as an industry, the tourist hotel zone grew up in the new elite residential areas. Since the Earthquake another demographic shift for the rich and powerful has occurred. Guatemala has begun to achieve a skyline of high-rise office buildings and hotels. These have arisen in this southern sector, and the elite have moved once more to the hills surrounding the city or into condominium developments. All of this has left the original downtown to a lower middle class. Meanwhile, vast sectors of the city — including the

precarious slopes of the ravines — have been given over to sprawling, unsightly slums and provisional settlements.

Very little about the low-income neighborhoods of Guatemala is not generic to the region, having been described in the *favelas* of Brazil or the *pueblos jóvenes* of Peru. They are best described as agglomerations of household. The construction is precarious, of corrugated metal sheets and whatever other materials (wood, plastic, brick, block, corn-stalks) is available. Floors are of dirt. Streets are of dirt. Drainage for water and sewage is non-existent. Intrahousehold water taps are the exception, communal faucets are the rule, and purchase of water from tank-trucks is common. In the city, electrification is generally complete although telephone lines are scares. With electricity comes the ironic paradox of electrical appliances (radios, cassette and CD players, televisions and VCRs) under the roofs of provisional domiciles. Shade trees and grassy areas are rare. In the dry season this makes for dust bowls; in the rainy season, for mud bowls. Such neighborhoods are subject damage to the natural elements such as earth tremors, flash floods, and (recently) wind storms.

Personal and property security has become precarious. Many migrants to the city came to find refuge from the crossfire of insurgents and military forces in their countryside hamlets. Now the menace is petty theft and organized youth gangs. Extortion, larceny and rape are the crimes of note. Access to patrol cars is difficult and police presence is minimal. A major recent concern by a frustrated citizenry is vigilante justice and lynchings. The elite are not immune to the rising criminality which involves house burglaries and kidnappings for ransom. Private security police for home and business is a flourishing growth industry. Ironically, the second leading industry in terms of income in foreign exchange is tourism. Security concerns in both the capital and the countryside may be a poison attacking the goose that lays the golden eggs of tourism dollars.

Analogueous to the experience throughout the region, structural adjustment — and the culture of structural adjustment — has supplanted a bloated state and municipal bureaucracy with its powerful unions. Once the tools and trophies of those who governed, the public servants have become the objects of a rush to downsizing and privatization of public services. Never efficient, municipal services and national functions such as public hospitals and schools, are in transition to decentralization and local responsibility (at best) and non-existence (at worst).

URBAN LIFESTYLE AND DIETARY PATTERN

It is safe to say that urban life-style in Guatemala has always been distinct from rural life-style. It is also rather evident that predominant rural life-style, that of agricultural work — either in subsistence or cash-crop cultivation, for men, and maintenance of a peasant household for women — has not changed substantially during several centuries. Work in construction in the cities can be as physically intense as work on the farm, but most of the occupations of men in the cities are more sedentary than those of the agrarian. For those who are born in the countryside and who migrate to the capital, there is a *transition* of activity pattern within the lifespan.

“Nutrition transition” is a concept which has been introduced by Prof. Barry Popkin (1) in which the “problems of under- and overnutrition often coexist, reflecting the trend in which an increasing proportion of people consume the types of diets associated with a number of chronic diseases.” The book by Prof. Klaus Pietzrik (2) and published by the International Life Science Institute, entitled “*Modern Lifestyles, Lower Energy Intake and Micronutrient Status*” sets the stage for the quantitative and qualitative consideration of this topic, as it relates the lower energy intakes of more sedentary life-styles to a lesser total intake of foods, and possibly of key sources of micronutrients. Hence, a con-

sideration of diseases related to dietary excess, but more specifically of chronic and degenerative diseases in which micronutrients in generous amounts may be protective.

Household diets for the low-income populations in Guatemala have changed in two dimensions. The basic menu at home is different from what is still eaten in the countryside, and more meals are eaten away from home. In a monetary economy (purchase) compared to a non-monetarized provisioning (self-production, gathering, barter) sets the pattern for a very different selection of foods. The issue can be framed in terms of availability and accessibility. To the shopper in the urban milieu, there is vastly greater selection of food than for the mother in the rural hamlet. In the province bordering the metropolitan area to the southwest, a rural-to-urban gradient in the number of items reported in a 7-day period in the gradient from a township to a village to a plantation was reported (3). The diversity of the diet was three-fold greater in the township as compared to the plantations. However, its accessibility, i.e. does it come within the household budget, is the greater determinant of how many different items are in the diet. The distillation of these forces is seen in a survey (4) with 52 pregnant mothers from the periurban neighborhood of Guajitos, interviewed from 9 to 14 times (mode: 14) during their third trimester of pregnancy in 1987. Over 706 person-days among these 52 women, 254 food and beverage items were reported as consumed. However, only seven items were common to all 52 women, and only 5% of the total of items accounted for 75% of total energy and protein intake for the population, with maize tortillas accounting for 25% of total energy.

The options for eating outside of the home have expanded rapidly for all of the visitors to and residents of the capital city. For the upper class and foreign tourists, restaurants and hotel dining rooms have proliferated. For the middle-class there are cafeterias and fast-food eateries, the latter specializing in fried chicken, hamburgers, pizza and specialty sandwiches. Street food are the primary option for the urban majority, the poor. Street foods have always existed, but with the proliferation of the urban population and the inability to return home from work for meals, the services of street-food vendors has proliferated (5, 6). With the exception of the Guatemalan—style hot-dog, the *mixta*, most of the meals and snacks are based on traditional Guatemalan foods.

Globalization of import-export of commercial foodstuffs has overtaken Guatemala, but it is expressed more on a franchise basis with actual manufacture of the products in Guatemalan factories. This is true for the highly visible beverages: Coca Cola and Pepsi Cola. Rolled oats and cornflakes are manufactured in Guatemala under the Quaker and Kellogg labels, respectively. Imports of wine from Chile, of chocolates from Switzerland and the USA. Beer and rum were true monopolies; two *cervecerias*, both owned by the same family, controlling the manufacture and importation of most beer. One *liquorera* has the same hegemony over sale and import of spirits.

Globalization interacts with currents that are intrinsic to local conditions. Maize is the cereal staple of MesoAmerica. The tortilla (corn pancake) and the tamal (baked corn) were the dominant cereal-based food at Guatemalan meals. White (bleached wheat flour) bread has been baked in bakeries in Guatemala since the colonial period, but it had been a minor constituent of the diet in deference to the maize products. At CeSSIAM the hypothesis of the existence of a gradient of increasing wheat bread consumption, displacing maize from the diet was confirmed (7). Another finding in that study was a progressive reduction in the weight and diameter of tortillas among the Kekchi from the most rural to the most urban settings. With respect to globalization, bread has become part of a franchise. *Pan Bimbo* is a mass produced standardized line of sandwich bread and packages pastries.

Vitamin intakes: A comparison of preschool children in five localities, two rural and three peri-urban neighborhoods of the capital,

was made in 1987 (8, 9). The average intake was estimated a 200 to 250 RE in the three urban sites. This was higher than the 125 RE in the remote location on the Rio Dulce, but less than the 299 RE in the nearby hamlet of Las Trojes. However, in terms of the percentage of subjects consuming an adequate intake of 400 RE, the three urban areas were numerically better off than the two rural settings.

Vitamin A intakes must be considered both in terms of the basic, "natural" foods in the diet, both of animal and vegetable origin, as well as intake from fortification. Guatemala is one of several Central American countries to have government-mandated fortification of sugar. This is a process developed at INCAP (10). The target level of retinyl palmitate per gram of sugar is 14 RE (50 IU), but the tolerances are set at from 11 to 17 RE. The recent National Micronutrient Survey (11) found an average, per person consumption of 60 g in the metropolitan area. The median fortification level fell well below the target, at 7 g, but this combination would provide 420 RE from sugar daily. Sources of vitamin A are from fortified foods has often been ignored in the past, but since fortification was re-instituted in 1989 the concern has become prominent. About half of the median intake of 427.3 RE of vitamin A in the diet of peri-urban toddlers in a community of Guatemala City is from fortified foods (12). The rest is from natural foods. Sugar, which, as analyzed, contained 3 RE/g contributed 2/3 of the fortificant vitamin A and 1/3 of all the vitamin.

For pregnant women in a peri-urban neighborhoods, performed in 1987-88 before the re-institution of sugar fortification and, using 24-h recall as the instrument, found median intakes of vitamin A to be in the 170 to 240 RE range (13).

The mean and median daily intakes of riboflavin were obtained from data on 217 rural and 86 urban school children aged 5 to 11 y (9). The intake of the former was 0.71 mg (median: 0.74 mg/day) whereas that for the latter was 1.07 mg (median: 0.82 mg/day).

Mineral Intakes: Iodine deficiency disorders have been common in Guatemala since the first systematic surveys in the early 1950s revealed a goiter rate of 38% (14). The same fortification law that mandates fortification of table salt at a level between 30 and 100 parts per million (ppm). Potassium iodate is the fortificant. The National Survey (11) found a median level of around 22 ppm. The estimate of individual salt intake, based on disappearance data for the metropolitan areas is 9 g per person. CeSSIAM has conducted studies with lithium labeled salt in a village near the capital, that suggests that adults consume more iodine than children, and that the 9 g figure is much too high for both populations (15). Aside from salt, there is virtually no source of iodine in the diet. In the capital, the supermarket as the source of salt tends to guarantee the highest adequacy (16).

The variation in the content of four mineral nutrients - calcium, iron, zinc and copper - in the traditional staple food, the maize tortilla was studied (17). They found that, per 100 mg of edible portion, the tortillas provided: 108 mg of calcium; 1.5 mg of iron; 1.8 mg of zinc; and 0.2 mg of copper. The impact of these differences, however, is modulated by the strict gradient in the volume of tortilla consumption from rural to urban. Urban mothers of a specific linguistic group, the Kekchi, were found to consume daily, on average: 444 mg calcium; 5.7 mg iron; 6.9 mg zinc, and 0.6 mg copper, from the most rural hamlet to a neighborhood in Guatemala City (7). As noted, this same study showed that white bread (pan francés) was the item that replace tortilla with urbanization. This white bread has lesser amount of all of these elements.

Consumption of zinc by pregnant women in Guajitos was 11.3 mg (range 5.8 to 20.7) based on the 706 person-days of 24-h recalls (18). School children aged 6-7 y in a low-income neighborhood (19). The mean daily zinc intake for boys was 10.1 mg/day and for girls 8.4 mg/day. The urban diet in Guatemala has also been assayed for the potential for the absorption of zinc to be reduced. The Zn/phytate ratio

for the women's diet averaged 18.8 and that for the children's diet averaged 12.1 and 9.9 for boys and girls, respectively. A critical level for significant inhibition is >20 . Thirty-eight percent of the women's diets exceeded this inhibitory threshold.

Additional mineral daily mineral intake data obtained in the 52 peri-urban, third-trimester women were as follows: calcium, 727 mg; copper, 1.3 mg; and manganese 2.8 mg (18).

Conclusions: Possible **compensating** factors for reduced energy intake would be a diversification of the diet and a net increase in **micronutrient density**. Also, in urban setting, the general sanitation of foods may be superior to that of rural homes, reducing micronutrient losses related to episodes of food-borne gastroenteritis.

SURVEY OF MICRONUTRIENT NUTRITURE

Data on the status of the metropolitan population exists with respect to vitamin A, iron, iodine, zinc and riboflavin. Vitamin A status in both the urban and rural areas has been dominated and determined by the fortification of sugar. Preschool children in the two rural locations (Rio Dulce, Las Trojes) had a tendency toward higher prevalences of low retinol levels and abnormal relative dose responses than those at the three urban sites in the 1987 (pre-fortification of sugar) CeSSIAM studies discussed above (8, 9). In the recent National Survey (Ministerio de Salud Pública), the national rate of retinol concentrations below 20 ug/dL was 15.8% for children from 1 to 5 years of age, but for the metropolitan area preschoolers it was only 10.4%.

The groups most vulnerable for iron deficiency and anemia are women of childbearing age and preschoolers. Of 44 non-pregnant women in Guajitos, 20% had "anemia," as defined by a packed cell volume of $<37\%$. For the pregnant women, using a cut-off criterion of 34% hematocrit, which is adjusted for the hemodilution of late pregnancy, the rate of "anemia" was only 4%. The National Micronutrient Survey (11) classified 23% of metropolitan Guatemala City women between 15 and 44 years as "anemic," as compared to 36% in the childbearing women across the republic. At CeSSIAM, a group of preschool children from a peri-urban neighborhood (Peronia) was compared with peers in the northerly province of Alta Verapaz (20). The number with low hematocrit values ($<38\%$) was in the mid-30% range for both populations, but the only 37% of former and 54% of the latter had deficient iron stores as defined by a plasma ferritin of <12 mg/L. The National Survey (11) again found a lower rate of anemia in the metropolitan area (15%), than as in the nation as a whole (26%) in children 1 to 5 years of age.

Iodization of salt has been variable over the recent history of Guatemala. In 1987, a nationally representative sample of school children were examined for goiter by palpation (21). She found, curiously, that the rate of thyroid enlargement was slightly higher in the urban areas (including the capital) than in the rural areas. More recently, the National Micronutrient Survey (11) measured urinary iodine concentration by regions. The mean of low iodine concentrations for the capital of 22.1% is identical to that of the nation as a whole, 22.2%. However, consistent with the goiter survey (21), the 22.1% rate of low iodine was lower than the 16.1% rate across the highlands (*altiplano*), which is largely rural.

Riboflavin deficiency is prevalent in Guatemala. Although this vitamin is found in avocados and in most green herbs, epidemiologically speaking, the limiting factor in riboflavin adequacy is a low milk and dairy product intake. Studies in elderly adults in six localities in Guatemala is enlightening (22). The rate of deficiency of elders samples in Guatemala City (50%) was only slightly lower than the 60% found in three rural populations. However, persons over 60 y of age in a dairy cattle region, had a riboflavin deficiency prevalence of only 33%. Access to dairy items and the frequency of their consumption, rather than geography, per se, continues to be the determinant. The riboflavin

nutriture of young school children, aged 5 to 11 y, were examined by erythrocyte glutathione reductase activity coefficients (EGRAC) (9). Blood was obtained on 102 rural and 180 urban children. The median activity coefficient was 1.24 in the former and 1.19 in the latter; 29% of the former, and 46% of the latter had an activity coefficient of <1.20 considered to signify deficiency. The freshness of the milk and cheese, as consumed, may be another factor in riboflavin status. We compared riboflavin status in schoolchildren from a rural, coffee-growing area and from a peri-urban neighborhood (9).

There is no ideal manner to measure zinc status. Data has been collected in 162 school children, aged 6 and 7 y. There were 89 boys and 73 girls. A total of 12.3% of the males, but only 1.5% of females had a low plasma zinc concentration of <70 ug/dL. With respect to hair zinc concentration, 63% of boys and 44% of girls had levels of <110 ppm. The principal findings of the cross-sectional, pre-intervention relationship were a tendency to greater weight (for height and for age) in those with low hair zinc (<110 ppm), as well higher mid-arm fat areas (19). In taste acuity, a functional index of zinc status, the recognition threshold for salt was higher in the low-hair-zinc subgroup. The same children underwent an intervention trial over 5 months with a cumulative dose of about 900 mg of oral zinc. The differential changes in the zinc and non-zinc groups were not found with respect to either total linear or ponderal growth. The effect of zinc was more on the composition of growth in terms of greater responses in increase in triceps skinfolds and better preservation of midarm circumference (23). These various measures, associations and responses have been interpreted as evidence of a prevalence of zinc deficiency.

PERSPECTIVES FOR THE NEAR FUTURE

Guatemala City lies in a valley in the midst of mountains, 5000 ft above sea-level. As it is perched on a plateau and surrounded by deep ravines, the margin for further territorial expansion is limited. In theory, that should eventually stem the tide of immigration to the capital. However, before that happens, saturation of the density of inhabitants will be probed. Limitations of potable water availability have already become manifest, and the prospects for resolving the situation are dismal. Neither the streets and boulevards nor the off-street parking are sufficient to contain the increase number of internal combustion vehicles. Gasoline is still leaded and the influence of automobile emissions on air quality has it heading toward the situation that is legendary in Mexico City. The middle and upper classes are remaining in the metropolitan area, but fleeing the city proper. This reduces the median income of those residents that remain. All in all, the general "liveability" of Guatemala City, especially for its poor, seems to be on a decline.

With this panorama of evolving chaos, crowding and collapse of infrastructure, we can develop both a bleak and a rosy scenario for micronutrient nutriture. The bleak scenario is one of a return to greater prevalences of micronutrient malnutrition. On the other hand, to the extent that measures such as fortification of sugar with vitamin A and salt with iodine are maintained, and quality control improved, hypovitaminosis A and iodine deficiency disorders might be kept at bay. Also, simply the greater diversification of the diet in the city is likely to reduce micronutrient deficiencies even if the population remains equally impoverished.

Moreover, the globalization of the diet as outlines above, will continue to advance. The traditional, high-fiber and low-fat fare which has been synonymous with Guatemalan cuisine will, with time, comprise less and less of the total diet. The diet will be more refined and more energy-dense, while daily pursuits will be more sedentary and less energy-demanding. The environment will become more contaminated with particles and chemicals. Persons will live longer. All of this is a

recipe for greater incidences of chronic diseases. How one would preserve Food-Pyramid guideline profile in the nutritional transition is hard to imagine. And, to the extent that a certain balance of micronutrients reduce free-radical formation and bolster the immune system, increasing intake of "antioxidant" micro-nutrients in the diet could be seen as an appropriate public health move. Some feel that a single, universal dietary prescription can minimize chronic diseases for all populations. My opinion differs from that point of view. The combinations and interactions of genetic and environmental factors — both protective and predisposing to chronic illness — varies from site to site. If we had the knowledge and wisdom, we could develop specific formulas for dietary and life-style change to counteract the specific circumstances of a given locality. However, as documented here and in other contributions, when it comes to the metropolises of Latin America, nothing is static, everything is dynamic, and change is ongoing, unpredictable and unstable. A prescription for today will logically be obsolete tomorrow. Hence, the more modest and universal guidelines may represent the prudent course. What they lose in targeted efficiency, they might gain in long-term sustainability, especially if the worldwide marketing of food becomes "health conscious" in the formulation of its food for export and franchise.

CONCLUSIONS

In his book on the longitudinal study of the village of Santa María Cauqué (located 38 km from Guatemala City), derived from a longitudinal study that lasted from 1962 to 1976, Leonardo Mata (24) suggests that the habits and life-style were virtually unchanged from the arrival of the Spanish, some 450 years earlier. Such was the apparent stability of rural Guatemala. In the years since the Earthquake of 1976, however, growth and change in the capital of the Republic has been both chaotic and exponential.

The greatest benefits for the present process is to compare and contrast the situation in Guatemala with that of Brazil. Guatemala combines three features that make it a suitable and apt subject for a comparative discussion of micronutrients and urban life-style. There is relatively abundant information about diets and nutritional status. The Institute of Nutrition of Central America and Panama (INCAP) has been operating for 48 years and has contributed a legacy of both understanding of how to study diet and nutrition and of tangible information. The Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), founded in 1985, has joined that tradition. Secondly, there is interest and focus on urban nutrition. CeSSIAM has been at the forefront on the subject from its founding, working closely with the urban nutrition activities of the International Union of Nutritional Sciences. Thirdly, in the Latin American context, Guatemala is among the least advanced in the process of the global shift from a rural, agrarian society to an industrialized, urbanized one. If nutrition transition (1) addresses the situation in which under- and overnutrition co-exist in the context of poverty and lack of power, then contemporary Guatemala City and the emerging urb has the characteristics. Only with respect to vitamin A nutriture is there a clear tendency to better nutritional status in urban — as compared to rural — areas. The situation for iodine and riboflavin may have been, as recently as the late 1980s, slightly worse among the urban population. Dietary change is accelerating and a less protective and more "pathogenic" diet is combining with a more sedentary life-style even for the urban poor, and the sharing the focus between alleviation of undernutrition and prevention of chronic diseases is warranted. Only through ongoing local scientific investigation, and transfer of its derivative fruits to the public health and agricultural sectors, combined with a linkage to the global effort to understand the mechanisms of urbanization and its nutritional consequences, can the best individual and

collective decisions for health and wellbeing be taken. Hopefully, the resources to allow for both expert inquiry and concerted action will continue to be made available.

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