## Original Article

# Concordance of diets and eating practices in a rural Guatemalan setting with the cancer prevention recommendations of the World Cancer Research Fund: estimates from existing dietary intake

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To evaluate concordance of eating practices in a rural Guatemalan setting with the 14-point cancer prevention recommendations of the World Cancer Research Fund/American Institute for Cancer Research. Two-hundred sixty nine food-frequency questionnaires based on the Willett model were analysed with respect to concordance with the recommendations, aimed at constraining intakes of: fat, sugar, salt, red meat and alcoholic beverages within specific ranges; restricting nutritional supplements' use for the express purpose of avoiding cancer; maximizing the consumption of: edible plants, especially fruits, vegetables, cereals, tubers and legumes; achieving dietary variety and nutrient adequacy; avoiding high-temperature cooking, and exposure to food additives, pesticides and residues; adequately preserving perishable and fungal-prone foods; maintaining normal body composition and regular levels of physical activity. The study was conducted in the county seat and three hamlets from the rural province of Santa Rosa. 214 females and 55 males were evaluated. Daily food servings of plant origin varied from 18.2 to 99.1% (74.6 ± 10.7%). The guidelines' criteria were met by more than 80% for total fat, red meat, ethanol, fruits and vegetables, cereals-tubers-legumes, sugar and nutritional adequacy, whereas 80% concordance was not met for nutritional supplements, and dietary variety. The other variables could not be evaluated. Concordance with national standards for micronutrient intake was not achieved most frequently for calcium, riboflavin, and iron. Guatemalan cuisine and diet in this rural setting has features of a cancer-protective diet, but complementary actions must be taken, within the social and economic realities of the region.

**Key Words: Total energy intake, cancer prevention, chronic disease epidemiology, nutritional epidemiology, food frequency questionnaire, dietary guidelines, Guatemala**

## Introduction

The incidence of chronic diseases is increasing worldwide, with a sharp acceleration in developing countries.[1] Food and diet have been implicated in the initiation, promotion and/or progression of cancer.[2] The World Cancer Research Fund and the American Institute for Cancer Research issued in 1997 the report "Food, Nutrition and the Prevention of Cancer: A Global Perspective"[3], recommending the adoption of the most prudent and protective eating habits, the maintenance of energy balance, the selection and deselection of certain foods and the handling, processing and preparation of foods in meals in order to decrease the risk of developing all forms of cancer.

The articles referred to in the WCRF/AICR Report, however, are based on research performed largely among populations of rich countries in the North, together with studies in metabolic wards and laboratories. The conse-

quences have been obscuring and underreporting the situation in middle- and low-income countries. Despite the fact that the WCRF/AICR Report[3] proposes to be universal across geography throughout the world, it would be necessary to identify the normal dietary patterns of both types course, new and extended investigation. One interim issue that can be addressed is that of the concordance of the

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the spontaneously and habitually chosen eating habits and ways of life in low-income countries and societies with the WCRF/AICR recommendations.[3] It is clear that valid information on total dietary intake pattern may be obtained from subjects in developed, industrialised countries through full-diet food-frequency questionnaires (FFQ).[4-6] The level of imprecision may be large for some nutrients, but the technique offers a standardized approach with minimal training requirements for data collection, minimal equipment and it allows subjects to be characterised according to their position in the distribution of intakes and practices.

Although the experience of using existing instruments outside of the US and Europe is much more limited for total-diet intake pattern approaches, some efforts have been undertaken in the staple-based context of developing countries, and this may be an adequate approach for establishing dietary patterns and their association with various diseases.[7-9] We have previously done an evaluation of the rural Guatemalan diet with respect to the Dietary Guidelines for Americans.[10] This type of inventory research enables a comprehensive overview of the scale of specific cancer promoting dietary and lifestyle behaviours in a global context providing the relevant food selection and habit domains have been queried. To examine the feasibility of undertaking dietary assessment procedures in Meso-America, a collaborative pilot study, funded by WCRF was undertaken in the Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM, Guatemala), the National Institute of Perinatology (INPer, Mexico) and the Centre for Applied Nutrition Research (Dundee, Scotland), in order to determine how many of the 14 WCRF/AICR recommendations (goals and guidelines) could be evaluated from commonly-used survey instruments, to provide degrees of concordance with the various recommendations and to assess the degree of nutritional adequacy of intake (for the nutrients currently estimated by available food composition tables)

## Methods
### Population
The data gathering was conducted in the Republic of Guatemala in 1994. A total of 269 individuals from the county seat of Santa Cruz Naranjo in the Santa Rosa Province and its hamlets. El Naranjo, Potreríos, and Don Gregorio were included. This included a convenience sample of 55 men (20.4%) and 214 women (79.6%), aged 16 to 86. The region is located in the eastern highlands of Guatemala, in a region devoted to the cultivation of coffee as a commercial crop and subsistence farming. The majority of the household earned their incomes directly or indirectly from agriculture.

Two hundred sixty-nine food frequency questionnaires that had been applied in 1994 in the county seat and three surrounding hamlets of the rural province of Santa Rosa, Guatemala were evaluated for concordance with the WCRF/AICR dietary guidelines[3] as expressed for population. The FFQ administration was part of a larger protocol on cardiovascular risk factors that had been approved by the Human Subjects Committee of the Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM) and subjects gave their informed verbal consent for interview after the purposes and confidentiality protections had been explained.

We first examined the 14 WCRF/AICR recommendations (Table 1) and determined that they actually have 17 components, from which exposure to food additives, pesticides and residues; body composition; physical activity; fungus-prone food storage, and cooking temperature could not be evaluated with the existing instrument (recommendations 2, 3 and 9-15).This process has been documented elsewhere.[11] Food items from the questionnaire were classified according to type of food: animal versus plant origin; fruit; vegetable; grain/starchy foods; sugar; alcohol; separated fats and oils, and red meat. Intake was calculated as number of servings per year of plant origin and percentage of total energy for each type of food. Patterns and portion frequencies, converted into

**Table 1.** WCRF Gudelines for t-he prevention of cancer.

| WCRF  Guidelines  for  the  Prevention  of  Cancer |
| --- |
| 1. Populations to consume [1] nutritionally adequate and [2] varied diets, based [3] primarily on foods of plant origin. |
| 2. *Population average body mass indices throughout adult life to be within the range BMI 21-23, in order that individual BMI be maintained between 18.5 and 25.* |
| 3. *Populations to maintain, throughout life, an active lifestyle equivalent to a physical activity level (pal) of at least 1.75, with opportunities for vigorous physical activity.* |
| 4. Promote year-round consumption of a variety of vegetables and fruits, providing 7% or more total energy. |
| 5. [1] A variety of starchy or protein-rich foods of plant origin, preferably minimally processed, to provide 45-60% total energy. [2] Refined sugar to provide less than 10% total energy. |
| 6. Consumption of alcohol is not recommended. Excessive consumption of alcohol to be discouraged. For those who drink alcohol, restrict it to less than 5% total energy for men and less than 2.5% total energy for women. |
| 7. If eaten at all, red meat to provide less than 10% total energy. |
| 8. Total fats and oils to provide 15% to no more than 30% total energy. |
| 9. *Salt from all sources should amount to less than 6g/day (0.25 ounces) for adults.* |
| 10. *Store perishable food in ways that minimize fungal contamination.* |
| 11. *Perishable food, if not consumed promptly, to be kept frozen or chilled.* |
| 12. *Establish and monitor the enforcement of safety limits for food additives, pesticides and their residues, and other chemical contaminants in the food supply.* |
| 13. *When meat and fish are eaten, encourage relatively low temperature cooking.* |
| 14. Community dietary patterns to be consistent with reduction of cancer risk without the use of dietary supplements. |

Our instrument did not evaluate guidelines in italics. Numbers in brackets identify the components of the various goals and guidelines

percentage of energy intakes, were compared to WCRF/ AICR guideline criteria.

### Survey instrument

The Willett food-frequency questionnaire[12], which lists 61 foods, served as the template for the instruments used in the present study, it was developed in the Spanish language and in common local names for the foods of interest. For use in Santa Rosa, preliminary interviews with key informants were held in which 24-hr recalls and questions about consumption of seasonally available foods were made in the county seat and the peripheral hamlets. These foods were then incorporated into a food-frequency form. Where the food item, e.g. milk, white bread, coffee, already existed in the basic instrument, the code number was conserved. Substitutions were made at code numbers for items in the Nurses' study not part of the rural Guatemalan diet; Guatemalan staples such as maize (tortillas, and tamales), occupied vacated code numbers in the list. When the adaptation of the FFQ was completed for the Santa Rosa population, there was a final roster of 88 food and beverage items for interviews. For purposes of analysis, however, certain items, such as different preparations of beans (Phaseolus Vulgaris) were collapsed into a single food category. The Willett FFQ was designed and developed for self-administration; however, given the high rates of illiteracy, and doubts about the cultural formation to understand concepts such as current and historical frequency of consumption, the data were filled out for each subject with the facilitation of a trained interviewer. A team of six students from the national university's school in the nutrition major constituted the field team in Santa Rosa in 1994.

### Data handling, reduction and analysis

In order to analyse food quantities, the portions from all questionnaires were standardised to cups, spoons, teaspoons, or 100g portions and their fractions according to the information registered in the questionnaire forms. The instrument used lists frequency of foods consumed as per month, week or day, as we wanted to analyse the yearly consumption of all foods, the categories were converted to per year as indicated in Table 2. After having registered all portions and frequency categories in an Excel Database (Microsoft, Redwood, WA, USA), they were multiplied in order to obtain total portions per year and then divided by 365 to obtain daily quantities. The database included nutritional values from the Institute of Nutrition for Centro America and Panama (INCAP)[13] food composition tables such as total daily energy (kcal),

**Table 2.** Conversion of food frequencies categories into yearly consumption

| Original | Converted |
|---|---|
| <1 / month | 1 / year |
| 1-3 / month | 24 / year |
| 1 / week | 52 / year |
| 2-4 / week | 156 / year |
| 5-6 / week | 286 / year |
| 1 / day | 365 / year |
| 2-3 / day | 912.5 / year |
| 4-5 / day | 1642.5 / year |
| >6 day | 2555 / year |

protein (g), lipids (g), carbohydrates (g), calcium (mg), phosphorous (mg), iron (mg), thiamine (mg), riboflavin (mg), niacin (mg), vitamin C (mg) and vitamin A (RE). These mathematical conversions (Table 2) allowed us to determine percentages of daily energy obtained from a given food item, daily macro- and micronutrient intake, as well as the respective food groups.

Nutrient adequacy (component 1 of guideline 1) was analysed comparing daily nutrient intake to Recomendaciones dietéticas diarias (Guatemala)[14], and expressed as percentage of the corresponding recommendations. Consumption of plants of food origin (component 3 of guideline 1) was obtained by dividing total number of portions by portions from food origin. Data were then analysed for means and standard deviations for descriptive purposes for the study population as a whole, by community and by sex; and compared with the WCRF/ AICR goals and guidelines that allow a quantitative analysis (recommendations 4 through 8; i.e. fruits and vegetables, starchy or protein rich foods of plant origin, refined sugar, alcohol, red meat, dietary fat).

Dietary-variety (component 2 of recommendation 1) was evaluated by dividing energy from the total food items consumed yearly by the energy from food items consumed daily obtaining a variety score in terms of percentage of energy from daily versus all food items. Comparisons between mean intakes across sexes, normalised appropriately, were conducted using the Student's t test, and comparisons of proportions in various dichotomised or three-way desegregated categories were made across sexes by the Chi-square test. A probability value of 5% was accepted as statistically significant.

### Results

Of the 14 recommendations with their 17 subcomponents, we have been able to address the concordance with 10 of the subcomponents with the archival data as collected on the modified Willett instrument in Santa Rosa in 1994.

**Table3.** Proportion of individuals below 100% of the Guatemalan nutrient recommendations

| | Ca | P | Fe | Thiamine | Niacin | Riboflavin | Vitamin A | Vitamin C |
|---|---|---|---|---|---|---|---|---|
| Women (N = 212)* | *.15* | .03 | *.30* | .02 | .09 | *.11* | .05 | .03 |
| Men (N = 54)* | *.13* | 0 | .02 | .07 | *.17* | *.22* | .06 | .06 |
| Total (N = 266) | *.14* | .02 | *.24* | .03 | *.11* | *.13* | .05 | .04 |

Numbers in *italics* are those on or above 10% specific nutrient deficiency; * 2 women and 1 man were excluded from the nutrient adequacy analysis because no age was registered in the questionnaire

### To consume nutritionally adequate diets

When analysing the adequacy of the diet with the Guatemalan nutrient recommendations, (Fig. 1), only 266 cases were analysed, because no age was registered for 2 women and 1 man. We found that all the nutrients which we could evaluate (calcium, phosphorous, iron, thiamine, riboflavin, niacin, and vitamins A and C) were, on average, above the recommendations, for the group as a whole as well as by gender. When determining whether any individuals had a specific low intake of any of the nutrients (Table 3), we found that the most frequently encountered substandard intakes were of calcium (14.3%), riboflavin (13.2%), niacin (10.5%) and iron (24.1%), for the group as a whole. When divided by gender, both men and women had an important prevalence of deficient intakes of calcium and riboflavin short of the recommendations, whereas this was true for iron only in women and for niacin only in men.

### To consume varied diets

The total number of different food items consumed during the year averaged 55 ± 18, whereas the number of different items consumed daily were 13 ± 7. When calculating the percentage of energy obtained from the same items consumed every day, 75.4 ± 15.1% came from the same food items, i.e. only 25% or less of the daily diet comes from different foods, indicating that overall dietary variety is limited.

### To consume diets based primarily on foods of plant origin

The diet of the rural Guatemalan population sample evaluated here was primarily based on foods of vegetal origin, as approximately 75% of the daily energy intake (74.6 ± 10.7%) was composed of grains, legumes, vegetables and fruits, whereas the remainder came from fats and oils, sugar, and products of animal origin. Of course, if we consider vegetable fat and vegetable oil and sugar to be plant-derived, the overall mean percentage of energy from edible plants would be considerably higher. The difference between

78.3% for the 55 males and 77.6% for the 214 females in the Santa Rosa sample was not statistically significant.

### To promote year-round consumption of a variety of vegetables and fruits, providing 7% or more total energy

Table 4 shows the data for energy consumption from each food group, disaggregated by the specific sites within the Santa Cruz Naranjo county, whereas Figure 2 compares the percentage of daily energy consumed from the different food groups with the amount recommended by the WCRF/AICR guidelines.[3] Specifically for the recommendation about consumption of fruits and vegetables, Figure 2 shows, that the amount of fruits and vegetables consumed is approximately two times higher than the 7% minimum recommended by WCRF/AICR, at 16% (15.8 ± 12.3%). When analysed separately by sex, this contribution of fruits and vegetables to total intake was not significant (data not shown).

### To consume a variety of starchy or protein-rich foods of plant origin, preferably minimally processed, to provide 45-60% total energy

The percentage of starchy and protein-rich foods (grains, legumes, tubers) ranged from a 15.6% minimum to a 95.6% maximum with the overall average of 63% for the 269 subjects (Table 4). This contribution was on average within the recommended limits of 45-60% in 50% of the sample overall, for both men and women (Fig. 2). However, if we extend this to combine the within the 45-60% and above, i.e. >60% into a single category, the overall percentage for the Santa Rosans was 75%, for both females and males. Hence a total of 2 men and 24 women in the respective subsamples derived less than 45% of their customary energy intake from this class of foods.

### Refined sugar to provide less than 10% total energy

Sugar intake, on average, is within the recommendation at 6.1% of total energy, ranging from 0 to 28.7% (Table 3).
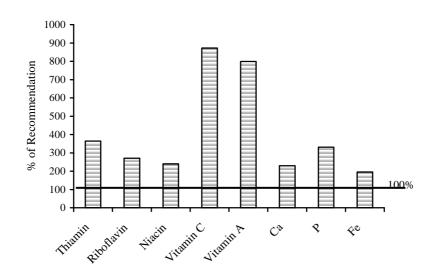


**Figure 1.** Average percentages of Guatemalan Nutrient Recommendations[14] achieved in the Santa Rosa population surveyed.

This did not differ across the sexes (data not shown). Overall 9.1% of men and 9.8% of women had sugar intakes constituting more than 10% of total energy. It is, however, difficult to evaluate exactly how much is added to regular foods, such as coffee, tea or desserts.

### For those who drink alcohol, restrict it to less than 5% total energy for men and less than 2.5% total energy for women

The group that was evaluated here reported an extremely low intake of alcohol (Table 4); this was well below the allowances of the guideline (Fig. 2), less than 1% by men as well as by women.

### Red meat to provide less than 10% total energy

Red meat has a very low consumption rate in this rural area of Guatemala, where the population consumes on average less than 5% of their daily energy from this food group (Table 4). A total of four individuals, of the total sample reported >10% of total energy from red meat sources.

### Total fats and oils to provide 15% to no more than 30% total energy

The average contribution of fat to the dietary energy was 24.5 ± 14.9% (Table 4), and this was comparable across the sexes (data not shown). The intake of total dietary fat was strictly within the recommended limits in 75.1% of subjects overall (Fig. 2). Those with an excess of 30% of contribution from these sources constituted 14.9%, with the high extreme being 60.4% of energy from total fats,

whereas those with intakes below 15% constituted 10% of the population, with the lowest contribution being 9.4% of energy.

### Community dietary patterns to be consistent with reduction of cancer risk without the use of dietary supplements

We recorded the use of nutritional supplements in 24.6% of the population; 25.4% of the men and 24.3% of the women were supplement users. However, the implicit sense of the WCRF/AICR recommendation # 14 is that individuals not use supplements as a substitute for dietary means, *to avoid cancer*. So without a specific question in the questionnaire regarding the individual's motivation for using a supplement, a full assessment of the concordance with the implicit sense of the recommendation cannot be made.

### Discussion

The developing countries of the world have to live with a double-edged sword, in the increasing appearance of chronic diseases as part of their mortality statistics for the adult population[1], combined with the still dreary presence of the deficiency diseases and their associated causes and consequences (i.e. infection and developmental retardation) in the juvenile population. Both edges of the sword have been related to inadequate dietary habits, with excesses and deficiencies, as well as with other lifestyle practices. Many national and international organizations are developing recommendations to prevent one or another side (deficiency or excess) of the morbidity and mortality spectrum. This is
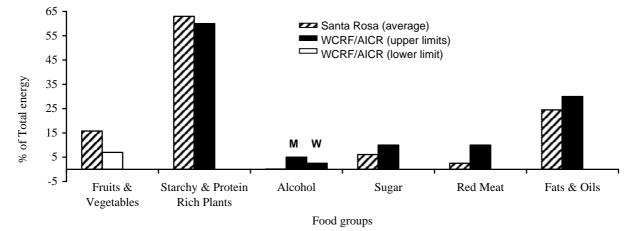


**Figure 2.** A comparison of the reference goals for intake of specific food items or macronutrients of the WCRF with the overall community averages from the survey data. The stripped bars represent the respective averages for the Santa Rosa survey population. The variance expression has been omitted for clarity of presentation. The white bar (fruits and vegetables) represents the minimum target percent of total energy that should be achieved from this food group. The black bars represent the maximal upper limit for intake, above which a population mean should not exceed. There is a gender-specific tolerable limit for alcohol of 5% of energy for men, and 2.5% of energy for women.

**Table 4.** Percentage of energy consumed from different food groups

|  | El Naranjo | Santa Cruz | Potreríos | Don Gregorio | Total |
|---|---|---|---|---|---|
| Fruits & Vegetables | 13.8 ± 12.5 | 13.2 ± 12.3 | 23.1 ± 11.1 | 14.3 ± 10.8 | 15.8 ± 12.3 |
| Starchy & Protein Rich | 63.5 ± 12.6 | 62.6 ± 15.1 | 63.3 ± 10.7 | 62.2 ± 16.1 | 63.0 ± 13.7 |
| Sugar | 6.7 ± 5.7 | 7.4 ± 5.3 | 4.2 ± 3.1 | 5.8 ± 3.2 | 6.1 ± 4.8 |
| Red Meat | 3.1 ± 2.7 | 2.0 ± 1.6 | 1.0 ± 1.2 | 3.2 ± 2.4 | 2.5 ± 2.4 |
| Fats & Oils | 4.6 ± 5.1 | 3.3 ± 3.3 | 2.0 ± 2.5 | 4.4 ± 3.8 | 3.8 ± 4.2 |

Data are presented as means ± standard deviation

the case of the report that the World Cancer Research Fund and the American Institute for Cancer Research published in 1997 for the prevention of global cancer.[3]

When issuing any kind of dietary recommendation, however, it is necessary to evaluate its relationship to traditional dietary patterns, particularly when trying to promote changes that may not be necessary in certain populations. It is relatively easy to advise middle-class people in the industrialised world to make healthy choices, as they have a wide variety of foods from which to choose. The dietary habits of most of the developing countries include a large amount of foods of plant origin, basically due not to healthful choices, but rather to the high prices and low availability of animal foods and the feasibility of home cultivation. So it is not unexpected to find, as we did in Guatemala, that the rural diets of developing countries are largely plant based. Hence, it would not be necessary to recommend an increase their consumption of plant-based foods, but simply to maintain their own traditional eating patterns.

However, this is opposed to the promotion of dietary variety, as most of the staple-food-based countries do not vary their diets from the basic food item(s), but create variety in terms of recipe preparations that may – or may not – contain additional ingredients. Thus for developing countries, it seems necessary to emphasize more the improving of variety than changing the relative amount of plant- or animal-origin foods, while recommending that the industrialised countries shift to some of these "ideal diets" adapting them to their own habits as a more food-based approach to nutrition education.[15]

Our approach here is not unlike that of Crane *et al.*,[16] in assessing the concordance of nationally representative survey populations with the *U.S. Dietary Guidelines for Americans*.[17] In contrast to the use of 1-day or 3-day food records of dubious stability for the individual[15], we have used an FFQ instrument, which presumably reflects the long-term habitual consumption.[12] Other authors have evaluated the concordance of different populations with various guidelines, mostly to assess if there has been any change in food habits after their release to the public. These studies have been generally conducted in high-income countries such as Australia, France, the United States, Denmark, Ireland, Finland, Sweden, Canada, and the European Community, where the starting point was an inappropriate diet that was supposed to have changed after recommendations for the prevention of chronic diseases were issued.[18-28] In a previous study, where we evaluated the concordance of the rural Guatemalan diet with the 1995 *Dietary Guidelines for Americans*, we found some areas of concordance that need not be modified and some others where education and improvement in availability and costs may improve their dietary habits.[10]

We tried to evaluate the traditional diet of a population where no recommendations for the prevention of chronic diseases have been given. The sample selection was very specific to a particular geographical niche in the Guatemalan countryside, and the unbalanced composition of men and women further reflects on its representativity, even for the whole population of adults of the region. Within the context of these caveats, however, the Santa Rosa population met the WCRF/AICR guideline criteria[3] by more than 80% in terms of most of the recommendations; that is to say that they consumed adequate or high quantities of fruits, vegetables, cereals, tubers, legumes and fats & oils, whereas their intake of alcohol, red meat and sugar was very low. This makes their diet predominantly concordant with the evaluable cancer-prevention goals and guidelines, with the exception of supplement use and dietary variety.

When evaluating any set of guidelines or recommendations, it seems only natural to determine the nutritional adequacy of its consequent diet. Having concluded that the Santa Rosan diet was highly concordant with the WCRF/AICR guidelines,[3] we went on to determine its nutritional adequacy, in terms of some of the specific nutrients listed in the Latin American food composition tables.[13] We found that some of the nutrients, such as calcium, iron and riboflavin, may be deficient in more than 10% of the individuals, thus putting them at risk. Moreover, since the FFQ approach used here tends to overestimate total energy, it would tend to exaggerate the value of micronutrients as well: hence, caution should be exercised in interpreting the data on nutritional sufficiency using the present approach. Most of the developing countries, particularly in the rural areas, have not been able to eradicate nutritional deficiency diseases, so one of the main worries of their governments is how to decrease them. Sugar fortification with vitamin A has been a way of decreasing its deficiency, particularly in the rural areas of Guatemala and other Central American countries, whereas vehicles of fortification for other nutrients are still being investigated. According to the WCRF guidelines[3], the diet for the prevention of cancer should be achieved without the use of supplements. As our data reveal, moreover, the population is in fact consuming some kind of nutritional supplements, however, the reason for using them is not specified, and so we cannot know if the use of nutritional supplements responds to deficiency states or to a possible cancer prevention motivation.

Guatemalan cuisine and diet in a rural setting showed many features of a cancer-protective diet; however complementary actions must still be taken, within the social and economic realities of the region, in order to ensure greater variety and universal nutritional adequacy, so as to come to terms simultaneously with malnutrition elimination and chronic disease prevention.

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Original Article

# Concordance of diets and eating practices in a rural Guatemalan setting with the cancer prevention recommendations of the World Cancer Research Fund: estimates from existing dietary intake

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目的：为了评估危地马拉乡村饮食行为与世界癌症研究基金/美国癌症研究院提出的癌症预防14点建议的符合度。方法：分析了269份Willett式食物频度调查问卷与14点建议的符合度，这些建议旨在限制脂肪、糖、盐、红肉、指定范围内的含酒精饮料的摄入量；限制防癌营养补充剂的使用；尽可能提高可食植物尤其是水果、蔬菜、谷类、块茎和豆荚的消耗量；实现饮食多样化和营养素的足量摄入；避免高温烹饪，以及食品添加剂、杀虫剂残留的暴露；充分贮存易腐烂和易感染真菌的食物；保持正常的体质组成和体育锻炼。结果：本研究在山区省—Santa Rosa 的郡政府所在地和三个村落进行，共有214名男性和55名女性参加。植物性食物占每日总食物供应量的18.2–99.1（74.6±10.7%）；脂肪、红肉、酒精、水果、蔬菜、谷类/块茎/豆荚、糖和营养摄入量与推荐标准的符合度在80%以上，而营养补充剂摄入量和饮食多样性的符合度并未达80%，其他的变量无法评估；某些微量营养素尤其是钙、核黄素、铁的摄入量未达到危地马拉国家标准。结论：所调查的危地马拉乡村地区的烹饪方式和饮食具有防癌饮食的特点，但也应根据当地的社会经济实际采取补足行动。

关键词：总能摄入量、癌症预防、慢性疾病流行病学、营养流行病学、食物频度调查问卷、膳食指导、危地马拉。