ONLINE SUPPORTING MATERIAL

CHINA FOOD GROUPING SYSTEM

I. Background

A variety of ways exist to describe patterns of food consumption according to different analysis scopes. One might measure a single food, food groups, or foods by level of processing. One might also measure foods by where foods are purchased or consumed: at home vs. away from home; time of day; or meal and snack patterns. These possibilities led a working group of UNC-CH and Chinese Institute of Nutrition and Food Hygiene (INFH) researchers to develop a food grouping system that summarizes food intake in a nutritionally meaningful way.

The complexity and variety of foods have led most researchers to use simple food grouping systems measuring 8-10 food groups, which include groups such as starchy staples (e.g., cereal-based foods), meats, and dairy products. We felt this approach aggregated foods into too few food groups to pick up important shifts in eating behavior. The approach also missed some key food trends with important health implications.

The purpose of this project is to make the food grouping system a useful tool for studying dietary patterns and the relationship between diet and health and for food and nutrition policy development. It is a system that virtually separates all foods and beverages into **7** categories and **42** useful, descriptive, and nutrient-based major groups. A total of 2,399 foods and beverages are included.

II. Development of the food grouping system

The procedures used to create the food grouping system are summarized below:

1. Step 1: Creation of food categories
2. Step 2: Development of food groups
3. Step 3: Formation of food sub-groups
4. Step 4: Incorporation of old and new foods

Step I: Creation of food categories

A total of 1,358 foods available in the CHNS datasets were first categorized into ‘major’ food categories. These foods are primarily raw foods/ingredients, as many of the foods included in

the 1991 China Food Composition Table (FCT) are only in raw form. Some cooked foods are also included. The food categories used in the 1991 FCT were used as a guide, and the categories were kept in the same order to ease interpretation. The 5 'major' food categories include the following:

1. Grains, cereals, beans, nuts, and products
2. Vegetables and fruits
3. Animal foods
4. Cooking oils, seasoning, and condiments
5. Other

Step II: Development of food groups

The creation of food groups within each 'major' food category was based on the following criteria: reflects meaningful nutrient differences; easy creation of groups; minimization of the total number of groups; must be systematically applicable to all foods; easy to interpret. Most of the food groups were formed based on the food groupings used by INFH, but additional criteria were also used for further food group classification. The decision to further classify the food groups was based on two main rationales:

1. Food groups indicate differences in nutrient composition (i.e., fat, protein, carbohydrate, vitamins, beta-carotene, and fiber).
2. Food groups reflect differences in socio-cultural meaning, food purchasing, preparation, and consumption behavior.

The additional criteria were dependent on the food categories and availability of information. The criteria fall under three main areas: nutrient variation; water and nutrient variation; and preparation method (**Supplemental Table 1**).

Application of the INFH food groupings and additional criteria resulted in the creation of **37** food groups. These food groups and their associated food categories are shown in **Supplemental Table 2**.

Step III: Formation of sub-groups

The food groups were next broken down into sub-groups, which are more sensitive to differences in nutrient composition and preparation methods. Some of the same criteria used for food group determination were also applied to the classification of sub-groups (e.g., high vs. low beta-carotene). Additional sub-group criteria include the following: fresh vs. canned; dried vs. wet; high vs. low-fat; soybean vs. non-soybean; wheat vs. rice-based; high vs. low water; egg white vs. egg yolk; fermented vs. not fermented; leaf vs. stalk vegetables.

An uncooked vs. cooked sub-group was formed given the nutrient variation in cooked vs. uncooked foods. Differences in energy, nutrients, and water composition for cooked vs. uncooked foods were considered when determining the nutritional values for cooked foods. Cooked foods were converted into raw food equivalents, since the majority of the foods included in the 1991 FCT are in raw form.

All sub-groups, their associated food groups, and food categories are listed in **Supplemental Table 3**.

Step IV: Incorporation of old and new foods
A total of 636 foods from the 1980 FCT were used for the 1989-1993 CHNS surveys. For the 1997 and 2000 CHNS surveys, 1,358 foods from the 1991 FCT were included. New foods from later survey years (2004 and 2006) have also been integrated into the food grouping system based on the 2002 FCT. A total of 608 new foods were added in 2007, resulting in 2,399 total foods in the most current food grouping system. Additionally in 2007, a new food group was added in order to identify fast food. Subgroups for the fast food group differentiate the food items into high- or low-fat fast food, ready-to-serve food, and snack foods. These additions are shown in **Supplemental Table 3.**

III. Development of the beverage grouping system
The development of the beverage grouping system consisted of a two-part process: the formation of beverage groups and sub-group development within each beverage group.

Step I: Creation of beverage groups
All beverages included in the CHNS datasets were first categorized into **4** main groups: (1) Alcoholic beverages; (2) Calorically-sweetened beverages; (3) Low-calorie beverages; (4) Milk beverages. The beverage grouping and sub-grouping processes were modeled after findings by the U.S. Beverage Guidance Panel.

Step II: Creation of beverage sub-groups
Given the range of beverages included in groups such as calorically-sweetened or milk beverages, sub-group formation was essential. **Supplemental Table 3** illustrates the various sub-groups within each beverage group.

SUPPLEMENTAL TABLE 1 Additional criteria for the determination of food groups

Additional Criteria	Definition	Rationale
Nutrient variation: High vs. low-fat	a. For red meats, poultry and game, low-fat = <10g fat/100g of edible meat (equivalent to <40% energy from fat) and high-fat = ≥10g fat/100g of edible meat. b. For pastries, cakes and cookies, low-fat = <15g fat/100g of food and high-fat = ≥15g fat/100g food.	a. 'Lean' and 'fatty' red meats, poultry, and game can be distinguished, which will allow inferences to be made in terms of the current Chinese dietary guidelines. b. The cut-off value was chosen because the % of energy from fat is ~40% of the total energy, and it was an easy number to use to separate foods in this category.
Nutrient variation: High vs. low beta-carotene	a. For vegetables, low beta-carotene = <90 retinol equivalents per 100 g food (edible part), and high beta-carotene = ≥90 retinol equivalence per 100 g food.	a. Beta-carotene, a source of vitamin A, is a critical antioxidant linked to reduced risk for cancers. Inadequate intake of vitamin A is an important cause of malnutrition. Studies show an increased risk in mortality for vitamin A deficient pregnant women.
Water and nutrient variation: Fresh vs. dried	a. Criteria are available from the 1991 FCT for the food names (e.g., fresh or canned fruits and vegetables vs. dried fruits and vegetables).	a. Food items in these groups differ with respect to water, energy, and nutrients based on if they are fresh vs. dried.
Preparation method: Fried vs. not fried; Pickled/salted vs. dried	a. Criteria are available from the 1991 FCT for the food names (e.g., dried vegetables vs. pickled or salted vegetables).	a. Consideration of the food preparation method was addressed where possible, given the effects of food preparation methods on health.

SUPPLEMENTAL TABLE 2 Food categories and food groups

Food Categories	Food Groups
Grains, cereals, beans, nuts and products (11 total food groups)	Raw and cooked rice; Wheat and flour products; Low-fat cakes, pastries and cookies; High-fat cakes pastries and cookies; Deep-fried wheat/rice/potato/bean; Corn flour/coarse grains and products; Starchy roots and tubers; Legumes; Bean products; Nuts and seeds; Starchy noodles and products
Vegetables and fruits (7 total food groups)	High beta-carotene vegetables; Low beta-carotene vegetables; Pickled or salted vegetables; Dried vegetables; Fresh and canned fruits; Dried fruits; Fungi and seaweed
Animal foods (12 total food groups)	Low-fat red meat; High-fat red meat; Meat products; Organ meats; Low-fat poultry and game; High-fat poultry and game; Eggs and products; Fish; Shellfish and other aquatic products; Milk products; Sweetened dairy products; Lard and butter
Plant oils, seasonings, and condiments (4 groups)	Plant oils; Salt; Other seasonings and condiments; Herbs and functional foods
Others (3 groups)	Infant formulas; Candy, sugar and other high-sugar foods; Other

SUPPLEMENTAL TABLE 3 All food and beverage groups and sub-groups

Food and Beverage groups	Sub-groups
A. Grains, cereals and products	
1. Raw and cooked rice	1. Uncooked 2. Cooked
2. Wheat flour and products	1. Noodles, uncooked, dried 2. Noodles, cooked, wet 3. Flour, grain 4. Buns/breads 5. Others
3. Low-fat cakes, pastries, cookies	1. Wheat-based 2. Rice-based
4. High-fat cakes, pastries, cookies	1. Wheat-based 2. Rice-based
5. Deep-fried wheat/rice/potato/bean	1. Wheat products 2. Rice products 3. Potatoes 4. Soy products 5. Bean products
6. Corn flour, coarse grains and products	1. Uncooked 2. Cooked
7. Starchy roots and tubers	1. Fresh 2. Dried 3. Fresh, high in beta-carotene 4. Dried, high in beta-carotene
8. Legumes	1. Soybean pods and sprouts 2. Other bean pods and sprouts 3. Soybean or soybean flours 4. Other bean and bean flours
9. Bean products	1. Med-high water content 2. Low water content 3. Fermented

	4. Others
10. Nuts and seeds	1. High-fat 2. Low-fat
11. Starch, Starchy noodles, and products	1. Flours or noodles (dried) 2. Starch jellies 3. Flours, high beta-carotene
B. Vegetables and fruits	
12. High beta-carotene vegetables	1. Fresh, non-leafy 2. Fresh, leafy 3. Canned
13. Lower beta-carotene vegetables	1. Fresh, non-leafy 2. Fresh, leafy 3. Canned
14. Pickled or salted vegetables	1. Low in beta-carotene 2. High in beta-carotene
15. Dried vegetables	1. Low in beta-carotene 2. High in beta-carotene
16. Fresh and canned fruits, melons	1. Fresh fruits 2. Fresh melons 3. Canned fruits 4. Fresh fruits, high in beta-carotene
17. Dried fruits	1. No sugar added 2. Sugar added
18. Fungi and seaweed	1. Fungi, fresh or dried & soaked 2. Fungi, dried 3. Seaweed, fresh or dried & soaked 4. Seaweed, dried
C. Animal foods	
19. Low-fat red meat	1. Beef 2. Mutton

	3. Pork 4. Others
20. High-fat red meat	1. Beef 2. Mutton 3. Pork 4. Others
21. Meat products	1. Beef products 2. Mutton products 3. Pork products
22. Organ meats	1. Beef organs 2. Mutton organs 3. Pork organs 4. Poultry organs 5. Other organs
23. Low-fat poultry and game	1. Chicken 2. Duck 3. Turkey 4. Other poultry, game
24. High-fat poultry and game	1. Chicken 2. Duck 3. Other poultry, game
25. Eggs and products	1. Whole eggs 2. Egg whites 3. Egg yolks 4. Egg or parts, powdered 5. Preserved whole eggs
26. Fish	1. Fresh 2. Preserved, dried, or canned
27. Shellfish and other aquatic products	1. Fresh or soaked 2. Dried
28. Milk products	1. Cheese

	2. Milk film 3. Yogurts
29. Sweetened dairy products	1. Wet 2. Dried or concentrated
30. Lard and butter (fats)	1. Butter, cream 2. Lard, tallow
D. Plant oil, seasoning, and other condiments	
31. Plant oils	No subgroups
32. Salt	No subgroups
33. Other seasonings and condiments	1. Vinegar 2. Soy sauce 3. Other seasonings
34. Herbs and other functional foods	1. Onion 2. Garlic 3. Ginger 4. Others
E. Other	
35. Candy, sugar and other high-sugar foods	1. Fruit jellies 2. Chocolates 3. Sugar, candy, honey, etc.
36. Infant formulas and child foods	1. Breast milk 2. Infant formula (dried)
37. Other	No subgroups
F. Beverages	
38. Alcoholic beverages	1. Liquors 2. White wines (including rice wines) 3. Red wines 4. Beers
39. Calorically-sweetened beverages	1. Fruit and vegetable juices

	2. Crystal and powdered drinks 3. Soft drinks 4. Sports, sugared, sweetened milk drinks 5. Coffee
40. Low-calorie beverages	1. Tea, leaf 2. Tea, drink 3. Bottled water
41. Milk beverages	1. Soy-based 2. Animal-based 3. Evaporated 4. Powdered 5. Other
G. Fast food	
42. Fast food	1. Fast food, high-fat 2. Fast food, low-fat 3. Ready to serve food, high-fat 4. Ready to serve food, low-fat 5. Snack food, high-fat 6. Snack food, low-fat