

Nutrition and Health Survey in Taiwan (NAHSIT) 1993-1996: Design, Contents, and Operations

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Abstract

The purpose of Nutrition and Health Survey in Taiwan (1993-1996) was to monitor the nutritional status, health status, life-styles, and health and nutrition related knowledge/attitude/practice in the whole population and in various age, sex, geographical, and ethnic groups. A multi-staged, stratified, clustered probability sampling scheme was used. There were seven strata: Hakka area; mountainous area; east coast; Peng-Hu islands; metropolitan areas; provincial cities and class I townships; and class II rural townships. Within each stratum, 3 townships or city districts were selected. And within each township or city district, 3 villages or city blocks were selected. The survey was carried out in 63 villages or city blocks in a season-balanced manner. Within each village or city block, 80 men and 80 women were sampled with designated numbers in each of the age (4-6, 7-12, 13-15, 16-18, 19-44, 45-64, 65+) and sex group. The target number was 10,080. The final sample size was 9,962. Response

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rate for household visit was 74%. For those who were interviewed, response rate for health examination was 65%. Operations of the survey were carried out by 3 groups of personnel (1) a scouting team, (2) two survey teams, and (3) a health examination team, quality control officers, and coordinator in the coordination center. Field work lasted for 3 weeks in each village. Health examination was scheduled on the 3rd and the 4th Sunday. The survey consisted of two parts. The diet and nutrition component included interviews on 24-hour recall, food frequency, nutrient supplements, vegetarian diet, and nutrition-related knowledge/attitude/practice (KAP), and measurements on nutritional biochemical indicators. The health component included questionnaires on lifestyles and disease symptoms and history and measurements on blood pressure, electrocardiogram, clinical chemistry, oral glucose tolerance test, and anthropometry.

Key words: survey, nutrition, diet, health, KAP, design, sampling weight, Taiwan

Introduction

The Bureau of Food Hygiene, Department of Health, Executive Yuan has sponsored a national nutrition survey at roughly five-year intervals since 1980 to monitor the nutritional and health status of the Taiwanese people. The first national nutritional survey (1) was carried out in 1980-81 by Huang et al.. A three-day food weighing method for assessing household dietary intake and anthropometric measurements were the two major components. The second survey (2-4) was carried out in 1986-88 by Lee et al. and also focused on dietary intake and anthropometric measurements. Nutrition and Health Survey in Taiwan (NAHSIT) 1993-96 was the third national survey in this series with broadened contents including 24-hour dietary recall, food frequency, nutrition and health knowledge/ attitude/ practice, and disease history and symptoms as appraised by household interviews and health examinations to evaluate nutrition and health status by biochemical and clinical approaches.

This survey intended to generate representative nutrition and health data for the whole population, for specific age and sex groups, and for each unique cultural and geographical stratum. A multi-staged stratified complex sampling scheme was used to obtain a representative sample of Taiwan residents.

Materials and Methods

Design

A multiple-staged, stratified, clustered, probability sampling scheme was used. All residents of Taiwan aged 4 and above who did not live in institutions from July 1993 to June 1996 were our targets. A total of 10,080 people, (3,360 per year) was planned. Our final sample size was 9,962 respondents.

Multiple stages: Taiwan consists of 359 rural townships, urban townships, or city districts. These 359 townships or districts were classified into 7 strata according to their cultural and lifestyle characteristics, geographical locations, and degree of urbanization. Included were Hakka areas, mountainous areas, two east coast counties, Peng-Hu islands, metropolitan areas, provincial cities and class I townships, and class II rural townships. Hakka are people who migrated to Taiwan a few hundred years ago from several counties of the Guangdong Province of China (5). Residents of mountainous areas are primarily aborigines who reside in the high lands of central and eastern Taiwan. The two east coast counties represent people who live in the narrow plain of the east coast who are geographically separated from the west side of Taiwan due to the barrier of the central mountains. Peng-Hu islands are the major island group offshore of Taiwan in the Taiwan strait. After setting aside townships or city districts with the above characteristics, other townships or city districts were then grouped into three levels: metropolitan areas (Taipei and Kaohsiung), provincial cities and class I townships, and class II rural townships in the order of reducing degree of urbanization.

Within each of the seven strata, three townships or city districts selected by the method of probability proportional to size (PPS) gave a final number of 21 townships and districts (Table 1). Within each township or district, three villages or city blocks selected by PPS gave a total of 63 villages or city blocks. We completed the survey for 21 villages or city blocks in a year and a total of 63 villages or city blocks in three years.

Cluster: Within each village or city block, two geographical locations were randomly selected from a series of computer generated random points. The selected random dot pointed to the first household of a region. Each qualified location required at least 75 households within an area of 200 square meters. If a location was not qualified, the next random number in line was used.

Table 1 Selected townships/or districts in each of the seven strata

Strata	Names of the townships/ or districts		
Hakka area	Yangmei	Hsinwu	Tahu
Mountainous area	Alishan	Chochi	Taoyuan
East coast area	Yuli	Fenglin	Tungfo
Penghu islands	Makung	Huhsi	Chimei
Metropolitan areas	Peitou	Chungchen	Kushan
Provincial cities and urbanization class I townships	Hsinchu	Sanchung	Tucheng
Urbanization class II townships	Tayuan	Fuhsing	Luku

Selection of household and individuals: Once the first household was selected, interviewers constructed a list of household addresses and demographic information of the household members for the next neighboring 75 households in the 200 square meters. Door-to-door visits were carried out to interview a designated number of people in each of the 14 age-sex groups (Table 2). If the designated number of people was not reached in the 75 households, the household number was increased. However, interviews were terminated if the target number of samples was not reached within a three week period.

Table 2 Target sample size by sex, age, strata, and season

Age (yr)	No. per strata, per season, per year			No. per strata			Total No.		
	Men	Women	Subtotal	Men	Women	Subtotal	Men	Women	Total
4-6	8	8	16	72	72	144	504	504	1008
7-12	16	16	32	144	144	288	1008	1008	2016
13-15	8	8	16	72	72	144	504	504	1008
16-18	8	8	26	72	72	144	504	504	1008
19-44	16	16	32	144	144	288	1008	1008	2016
45-64	16	16	32	144	144	288	1008	1008	2016
65+	8	8	16	72	72	144	504	504	1008
Total	80	80	160	720	720	1440	5040	5040	10080

Seasonal effect: Seasonal effect was considered by separating a year into three seasons (Nov. to Feb., Mar. to Jun., and Jul. to Oct.). A pseudo-Latin square design was used to queue the survey sites to balance the seasonal effect. It was arranged in such a way that in a given season, seven villages or city blocks, each from one of the seven strata was visited. In addition, three villages or city blocks, balanced in season, each from one of the three townships or districts, have been visited in each stratum each year.

Sample size and response rates

There were 9,962 subjects (4,964 men and 4,998 women) who responded to the household interview (Table 3). The response rate was 74%. All respondents were invited to participate in a health examination in a clinic set up in the neighborhood. Among those who were interviewed, 6,464 subjects participated in the health examination. The age and sex distribution of the participants was shown in Table 3. The response rate for the health examination was 65%.

Table 3 Sample size by sex and age

Age (yr)	Questionnaire			Health examination		
	Men	Women	Subtotal	Men	Women	Subtotal
4-6	469	488	979	322	399	661
7-12	1008	1003	2011	737	731	1468
13-15	592	598	1190	366	398	764
16-18	377	373	750	194	216	410
19-44	1013	1040	2053	526	657	1183
45-64	978	989	1967	630	689	1319
65+	505	507	1012	332	327	659
Total	4964	4998	9962	3107	3357	6464

Statistical analyses

Due to this complex multistage sampling design, probability being sampled differed from sample to sample. In order to produce representative estimates of certain attributes, a weighing process was needed. Weights were generated by post-stratification method. The sample was stratified into 238 groups ($7 \times 2 \times 17=238$) by seven strata, by sex, and by age (4-6, 7-9, 10-12, 13-15, 16-18, 19-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75+). The sample size in each stratum-, age-, and sex- group was enlarged to the corresponding national scale, based on the 1995 population size in Taiwan (6). Since the response rates for household interview and for physical examination were different, two separate weights were established.

Planning and operational details

From July to December 1992, various PI meetings were held to decide upon the survey objectives, contents, sampling design, field work mechanisms, and questionnaires. Three pilot studies were carried out from January to June 1993 to evaluate the questionnaires, various assessment tools, and operation details. The field work of the survey was carried out for a complete three years from July 1993 to June 1996.

Operations of the survey were carried out by 3 groups of personnel: 1. a scouting team, 2. two survey teams, and 3. a health examination team, quality control officers, and coordinator in the coordination center. The scouting team was in charge of locating the two first households in each village/city block, visiting local influential figures, arranging housing for the interviewers and clinic location for the health examination, collecting or making local map, posting posters and announcing the survey in local meetings.

Two survey teams, each with five members, conducted interviews all year round.

They carried out household interviews in each village for three weeks and participated in the local health examinations on the third and the fourth Sunday. They had a one-week vacation after visiting each site. Their responsibilities included obtaining informed consents, basic information on the households and individuals, blood pressure measurements, interviewing subjects for all questionnaires, and notifying them for health examination. Process of cross-checking the questionnaires and filling the missing values was coordinated daily by the team leader. On-site data entry was carried out for the 24-hour recall data to avoid unclear and missing food items.

Technicians from the coordination center traveled to the survey sites to set up health clinics and carry out health examinations on 42 weekends (2 x 21) in each survey year. The coordination center was also in charge of sending out official letters to local government officials to request cooperation, arrange the visit schedule of the survey team, keep track of supplies, arrange for laboratory tests, send out laboratory results to participants, maintain bio-specimen bank, arrange double data entry, execute logic check for data errors, manage data files, carry out preliminary data analysis, and write a survey report for the government.

Survey contents (7,8)

General and socio-demographic information collected were age, sex, education level, occupation, marital status, ancestral origin, housing condition, and family structure.

Diet and nutrition

Included in the questionnaire were 24-hour dietary recall, simple food frequency, habits of taking nutrient supplements and vegetarian diet, and knowledge/attitude/practice on nutrition and health. Blood and urine samples were collected for the measurements of hemoglobin, transferrin saturation, serum ferritin, vitamin A, E, B₁, B₂, B₆, folate, urinary electrolytes, and others.

Health status

Included in the questionnaire were questions on lifestyles (smoking, alcohol consumption, and exercise), disease symptoms and history, reproductive history for women, back pain, bone fractures, transient ischemic attack, and angina pectoris. Blood samples were drawn to measure total cholesterol, HDL-C, triglyceride, uric acid, SGOT, SGPT, glucose, and oral glucose tolerance test. Other health parameters were anthropology (height, weight, triceps skin-fold, sub-scapular skin-fold, and circumferences of waist, hip, upper arm, and wrist), blood pressure, and electrocardiogram.

Quality controls

Quality assurance procedures were incorporated into every aspect of data collection. One-week training courses were offered to the potential interviewers who had a college degree in nutrition or related fields. Only those who passed the test were recruited as interviewers. There was retraining in the mid-year every year. Record

sheets were designed for every operation to ensure the quality. Procedures of on-site key-in and filling in missing data were designed for the 24-hour recall. For other questionnaires, the team leader coordinated on-site cross-checking and correcting process. In addition, double key-in procedure and logic checks were carried out in the coordination center. For laboratory data, 5% split samples were prepared in the field. Reproducibility of the laboratory findings was monitored.

Summary and Discussions

NAHSIT 1993-96 adopted a multi-staged, stratified, clustered sampling scheme and surveyed 9,962 subjects. Inference can be made not only to the whole Taiwan population, but also to various age and sex groups and cultural and geographical strata. There were several unique features in NAHSIT. For the first time, a nation-wide survey incorporated a comprehensive health component in Taiwan. The data of this survey will provide information on both the current nutritional and health status of the Taiwan residents and on how nutritional status and lifestyles affected health and diseases in Taiwan.

In this survey, 24-hour dietary recall and a simple food frequency questionnaire were used to assess nutritional status of the individuals to replace the inventory method used in past surveys. Food models and operational details for 24-hour recall have been designed, validated, and documented for Chinese in Taiwan. Therefore, age- and sex- specific information on dietary and nutritional intakes was obtained. This information is useful in designing the nutrition policy for specific age and sex groups. Nutrition and health related knowledge/ attitude/ practice was also a new component which is important in designing nutrition educational strategies and materials.

NAHSIT was the results of collaborative work among nutritionists, epidemiologists, health educator, statisticians, and medical professionals. Detailed planning was carried out on sampling scheme, design of questionnaires and health components, mechanism of the field work, and quality controls. A vast amount information has been and will be produced on nutritional and health status of the Taiwan people and on relations between diet, nutrition, and diseases.

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