Original

The demography of food in health security: current experience with dairy consumption in Taiwan

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To establish a food guide, the 'total diet' needs to be considered, based on prevailing patterns of food and nutrient intake; these will be culturally acceptable and recognize the prevailing social and economic conditions that affect food availability. Dairy produce is a good source of high quality protein, and provides significant amounts of vitamins and minerals. People who consume more dairy have higher intakes of calcium and vitamin B2 with less chance of deficiency. We used four National Nutrition Surveys in Taiwan (NAHSITs) to establish the current demographic predictors of dairy intakes, an indicator of food security in an affluent society. There was a U shape relationship between dairy consumption practices (whether or not) and age. In Taiwanese, the practice is higher in school children (49.3%), adolescents (32.1%) and elderly (43.6%) than it is in middle age (22.2-25.9%). Average daily dairy intake decreases with age; in the elderly, the intake is less than half a serving. Forty seven percent of first grade children consumed a serving or more of dairy while the 6th graders dropped to 37%. Less than 20% adults consume one serving or more a day. The rate increases to 40% for elderly. Physiologic limitation and dietary habit account for 25% and 50% of dairy avoidance, respectively. Education, financial status, ethnicity, regionality and health seeking behaviors are determinants of dairy consumption in all age groups. There is a need for alternative Food Guides for non-dairy consumers. Attention to dairy intake for socioeconomically disadvantaged groups is required.

Key Words: dairy, demographics, dietary quality, health, NAHSITs

INTRODUCTION

Food security was defined by the US Agency for International Development as "When all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life". Achieving food security requires that the aggregate availability of physical supplies of food is sufficient, that households have adequate access to those food supplies through their own production, through the market or through other sources, and that the utilization of those food supplies is appropriate to meet the specific dietary needs of individuals.[1] On the other hand, the Life Sciences Research Office has defined food insecurity as "Exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain."[2] Both food security and insecurity include psychological and socio-cultural dimensions.

Selected population characteristics, such as gender, age, ethnicity, education, occupation, and even location, are frequently used in economic and market research. Distributions of values within a demographic variable, and across households, are both of interest, as well as trends over time.[3]

To establish a Food Guide, the "total diet" needs to be considered, based on prevailing patterns of food and nutrient intake; these will need to be culturally acceptable and to recognize the prevailing social and economic conditions that affect food availability. Dairy produce is a good source of high quality protein, and provides significant amounts of vitamins and minerals. People who consume more dairy have higher intakes of calcium and vitamin B_2 (riboflavin) with less chance of deficiency.[4] A British cohort study showed that people who consumed more calcium and dairy products in childhood tended to avoid stroke and live longer than those who did not.[5] However, dairy intake was higher in households with higher socioeconomic status. In addition, those who ate the most dairy also ate the most fruit and vegetables, so they had the healthiest diets overall. Increased dairy

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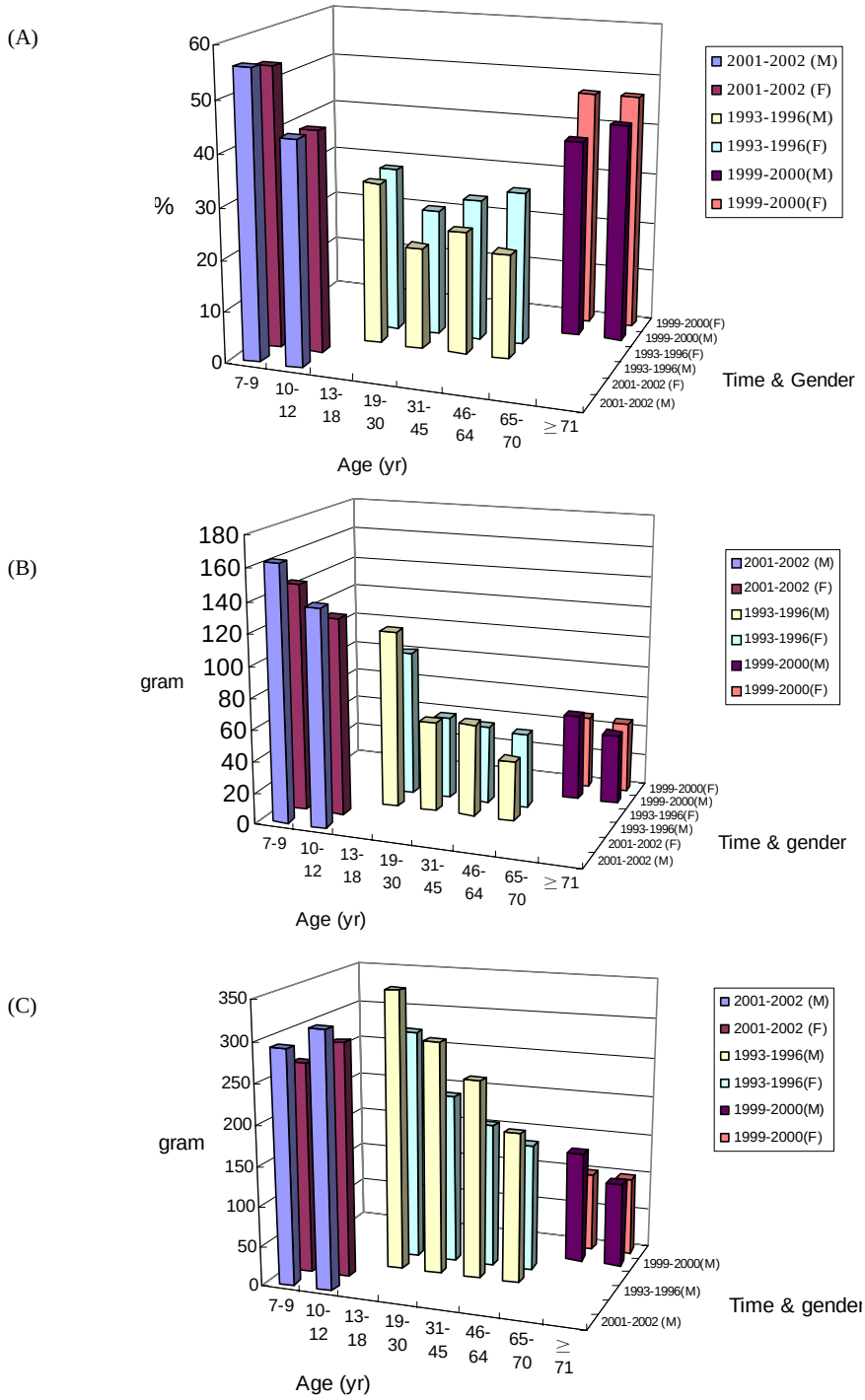

Figure 1. Age-gender-specific dairy consumption status by 24-hr dietary recall, 3 NAHSITs. (A) prevalence; (B) mean dairy consumption in grams for dairy eaters; (C) mean dairy consumption in grams for total population.

products in younger life seem to be a marker for those who have a more reasonable diet.

Taiwanese are recommended to consume one to two servings dairy a day. However, given limited dairy produce and the reliance on imports, the average dairy availability is only 0.6 serving per caput per day.[5] The purpose of the present study was to establish the current demographic predictors of dairy intakes as an indicator of food security in an affluent society.

METHODS

Study participants

Data for this paper were obtained from four population representative Nutrition and Health Surveys in Taiwan (NAHSITs) between 1993 and 2008. NAHSITs were national survey aimed at studying the nutrition and health status of free-living people aged four or older in Taiwan. More details about the study design and sampling methodology are provided by Pan et al.[6-9]

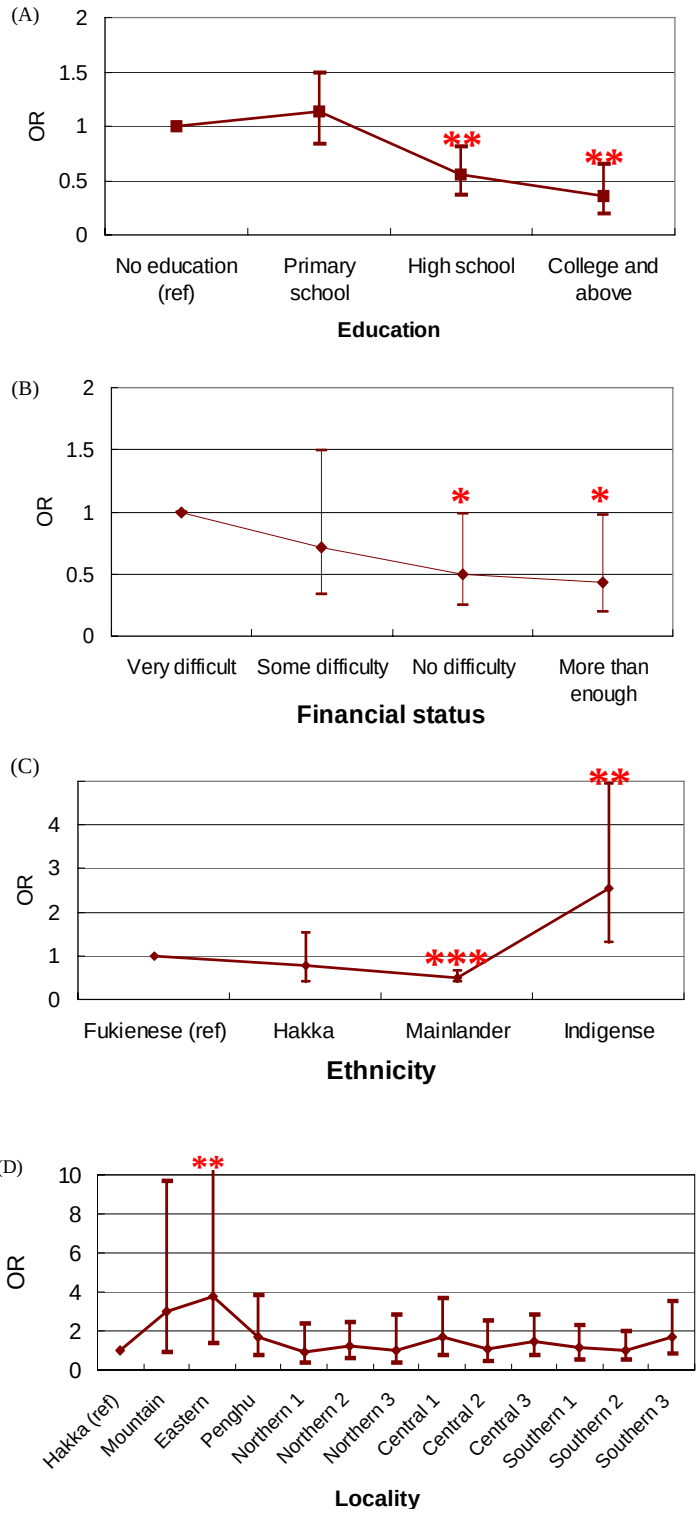

Figure 2. Odds ratios for not-once-a-day dairy compared to referent group in the elderly, NAHSIT 1999-2000. (A) Education; (B) Financial status; (C) Ethnicity; (D) Locality. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Data collection

The survey involved face-to-face interviews. Data collected included demographic variables; dietary intakes: 24-hour dietary intake and a simplified food frequency questionnaire (FFQ); life-style related variables: smoking, alcohol consumption, betel nut chewing, and physical activity; medical history; and medication usage. Physical examination included anthropometric measurements and fasting blood samples were collected.

Estimation of dairy intakes

Daily dairy consumptions were calculated for the participants by using dietary information provided from a 24-hour dietary recall and FFQ. The 24-hour dietary recall provided population means and FFQ provided the frequency of dairy consumption over time.

Demographics

Demographic variables included in the present study were gender, age, ethnicity, residential area, education (mater-

nal education for school children), financial status (perception and household income).

Statistical analysis

All data were weighted to represent the population in Taiwan. The population size of each sex/age group in each stratum was obtained from the national household registry system. The sampling weights were calculated by dividing the population by its corresponding sampling weights to represent the people of his or her own sex/ age group in the stratum. All the analyses were carried out using SAS version 8.01[10] statistical software and SUDDAN version 8.0[11] was used to account for the sampling design. Logistic regression analyses were used to examine the effect of demographic variables on dairy consumption status. Statistical significance was defined as $p<0.05$.

RESULTS

We found that there was a U shape relationship between dairy consumption practices (whether or not) and age. In Taiwanese, the practice is greater in school children (49.3%), adolescents (32.1%) and elderly (43.6%) than it is in middle age (22.2-25.9%) (Figure 1-(A)). Average daily dairy intake decreases with age; in the elderly, the intake is less than half a serving. Median intakes in grams were 260, 270, 249, 172, 73.5 and 44.4 for children, adolescent, 19-30, 31-45, 46-64 years and elderly, respectively (Figure 1-(C)). Forty seven percent of first grade children consumed one serving of dairy or more while the 6th grade dropped to 37%. Less than 20% of adults consumed one serving or more a day. The rate increased to 40% for elderly. (data not shown)

Among 4,471 NAHSIT 2005-2008 participants, 45.4% ate no dairy. Physiologic limitations (diarrhea, 22%; bloated, 2.9%; constipation, 1.3%) account for 25% dairy avoidance. More than half the population reported that dairy was not part of their diet due to “no such habit” (32.2%), “dislike” (17.1%), “no right time” (10.3%), or “dared not to” (7.1%). Three percent of participants reported that high cost was the reason, particularly for those who were from the Eastern region and for indigenes. (data not shown)

Education, financial status, ethnicity, and locality were four significant demographic determinants for not-once-a-day dairy in the elderly. Those elderly with high school or more education compared to those who with no education, had significant lower relative risk of not-once-a-day dairy. The same results were found for perceived financial status. Those elderly without financial difficulty or “more than enough” had significant lower chance for not-once-a-day dairy. Aboriginals had higher chance compared to Fukienese while immigrant Chinese Mainlanders had significant lower chance. Elderly who lived in the Eastern region had significantly higher risk compared to those who lived in the Hakka region. (Figure 2) In addition, elderly who were not supplement users (OR = 2.30), smokers (OR = 2.04) or betel nut chewers (OR = 2.48) also had higher risk for not-once-a-day dairy.

In addition to supplement use, in school children, maternal education level and household monthly income were two significant demographic predictors for no dairy intake. (data not shown)

DISCUSSION

From these four national nutritional surveys, we found the Taiwanese population have low intake of dairy products. Dairy is not a habitual food for more than 40% in this population. Dairy consumption correlates with certain demographic variables (age, gender, education, financial status, ethnicity and regionality), health seeking behaviors (supplement use) as well as life-style related variables (smoking and Betel nut chewing).

Implication to nutrition policy

- Should provide alternate Food Guides for non-dairy consumers.
- Pay attention to dairy intake for socio-economically disadvantaged groups.

Future work

- Include food security measurement in future NAHSITs.
- Consider the impact of changing demography: aging, immigration, family structure, in food security

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AUTHOR DISCLOSURES

Meei-Shyuan Lee, Lin-Yuan Huang, Mei-Chun Chen, Mark L Wahlqvist, and Mark L Wahlqvist, no conflicts of interest.

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糧食與衛生安全之人口學：目前乳製品攝取之台灣經驗

飲食指南的制訂必須考慮「整體飲食」，以當代的飲食型態及營養素攝取為準。更重要的是能夠與影響食物可獲性的族群文化、社會經濟條件吻合。乳製品是高品質蛋白質良好來源，並且提供相當量的維生素與礦物質。攝取較多乳製品的人，會獲得較高的鈣質與維生素 B_2，發生缺乏症的機會較低。因此，攝取乳製品是一個富裕社會糧食安全的指標。我們利用臺灣四次國民營養健康狀況變遷調查的資料，找出目前乳製品攝取之人口學預測因子。結果發現乳製品攝取率（是或否）與年齡呈現 U 形曲線。台灣的乳製品攝取比率，學童(49.3%)、青少年(32.1%)及老人(43.6%)較青壯年成人(22.2-25.9%)高。每日平均攝取量隨年齡上升而下降，老人不及半份。攝取乳製品一份或以上的一年級學童有 47%，到六年級學童則降至 37%；少於 20%的成人每日攝取一份或以上，老人則上升至 40%。生理因素及飲食習慣，分別占台灣人不攝取奶類食品原因之 25%及 50%以上。教育程度、經濟狀況、氏族、區域性及健康追求行為是所有年齡層的乳製品攝取的決定因素。對非乳品攝取者而言，需要一套替代的飲食指南。並有必要關注社會經濟弱勢族群之乳製品攝取。

關鍵字：乳製品、人口學、飲食品質、衛生、台灣國民營養健康狀況變遷調查