

**Research and Professional Briefs**

# Contribution of Take-Out Food Consumption to Socioeconomic Differences in Fruit and Vegetable Intake: A Mediation Analysis

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**ABSTRACT**

Lower fruit and vegetable (F/V) intake among socioeconomically disadvantaged groups has been well documented, and may be a consequence of a higher consumption of take-out foods. This study examined whether, and to what extent, take-out food consumption mediated (explained) the association between socioeconomic position and F/V intake. A cross-sectional postal survey was conducted among 1,500 randomly selected adults aged 25 to 64 years in Brisbane, Australia, during 2009 (response rate 63.7%, N=903). A food frequency questionnaire assessed usual daily servings of F/V (0 to 6), overall take-out consumption (times per week), and the consumption of 22 specific take-out items (never to once per day or more). These specific take-out items were grouped into “less healthy” and “healthy” choices and indexes were created for each type of choice (0 to 100). Socioeconomic position was ascertained by education. The analyses were performed using linear regression, and a bootstrap resampling approach estimated the statistical significance of the mediated effects. Mean daily servings of F/V were  $1.89 \pm 1.05$  and  $2.47 \pm 1.12$ , respectively. The least educated group members were more likely to consume fewer servings of fruit ( $\beta = -.39, P < 0.001$ ) and vegetables ( $\beta = -.43, P < 0.001$ ) compared with members of the highest educated group. The consumption of “less healthy” take-out food partly explained (mediated) education differences in F/V intake; however, no mediating effects were observed for overall and “healthy” take-out consumption. Regular consumption of “less healthy” take-out items

may contribute to socioeconomic differences in F/V intake, possibly by displacing these foods.

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Socioeconomically disadvantaged groups experience a higher prevalence of cardiovascular disease and type 2 diabetes and their associated risk factors, including overweight/obesity (1-3). The likelihood of developing these chronic conditions can be lowered by regularly consuming an adequate amount of fruit and vegetables (F/V) (4,5). Socioeconomically disadvantaged groups are more likely to have a diet that is characterized by lower F/V intake compared with their advantaged counterparts (6-8), and these dietary differences are thought to be one contributing factor to socioeconomic health inequalities (1,2).

To date, most studies have documented the nature and extent of socioeconomic differences in F/V intake (6,9); however, very few have investigated why these intake differences exist. One possible explanation for the lower F/V intake among lower socioeconomic groups is their take-out food consumption. Socioeconomically disadvantaged groups are more likely to eat/purchase take-out and fast food compared with advantaged groups (10-12), and these foods are associated with low diet quality, including reduced F/V intake (13-15). These findings suggest that take-out food consumption may be displacing F/V intake.

Previous studies have primarily examined fast foods that are typically energy dense (10-14). Take-out foods, on the other hand, encompass a wide variety of food types that range from energy dense to relatively nutrient rich, and can be categorized into “less healthy” and “healthy” choices according to their nutritional profiles. Choosing different take-out food-types may be socioeconomically patterned because disadvantaged groups tend to have less healthy diets (16,17). Furthermore, depending on the types of take-out food choices, the magnitude of the effect on F/V intake may be different. A recent Australian study reported that participants who consumed “less healthy” take-out foods in the previous 24 hours were significantly less likely to eat any F/V compared with those who did not; however, opposite associations were seen for “healthy” take-out foods (18). From these findings, it was hypothesized that socioeconomic differences in F/V intake may be mediated by take-out food consumption and, especially, by the choice of take-out food. This previous Australian study had a number of limitations. First, it used 1995 data, and the range and sales of take-out food have increased substantially during the past 16 years (19,20). Second, the study

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did not quantify the contribution of take-out food to socioeconomic inequalities in F/V intake. Third, the study combined F/V intake into a single dichotomized measure (consumed, not consumed), which did not allow a separate examination of the association between take-out food consumption and F/V intake, or an assessment of how take-out foods are associated with meeting the recommended intakes of F/V.

Our study advances knowledge of the factors contributing to the lower F/V intake of socioeconomically disadvantaged groups by examining whether take-out food consumption mediates socioeconomic differences in F/V intake, using data collected in 2009 and more detailed F/V intake measures. Take-out food is defined as foods or meals that are pre-prepared commercially and require no further preparation by the consumer, and can be consumed immediately after purchase.

## METHODS

Ethical approval was granted by the Queensland University of Technology Human Research Ethics Committee (ID 0900000445).

### Study Participants

This cross-sectional study was conducted in the Brisbane metropolitan area (Australia) between July and September 2009. A total of 1,500 adults aged between 25 and 64 years were randomly selected from the electoral roll of the Brisbane statistical subdivision. Data were collected by a self-administered postal survey (21) that asked about usual take-out food consumption, F/V intake, and sociodemographic characteristics. A total of 903 participants completed the survey (response rate 63.7%). Respondents who had missing or inadequate information on age, sex, education, take-out food consumption, or F/V intake were excluded from the analyses ( $n=98$ ), reducing the analytical sample to  $n=805$ .

### Outcome Measures

Standard questions were used to assess F/V intake (22). These questions are used widely (15,23,24) and have been shown to be valid measures of F/V intake (25). Fruit intake included pure juices, raw, cooked, canned, frozen, or dried fruits, and was measured by asking respondents how many servings of fruit they usually ate daily. A standard serving size for fruit was defined as one medium piece or two small pieces, or  $\frac{1}{2}$  c juice. Five response options ranged from “don’t eat fruit,” to “six or more servings per day.” Similar to that used in previous studies (26-28), responses were: no fruit=0.0, one or fewer servings per day=1.0, two to three servings per day=2.5, four to five servings per day=4.5, and  $\geq 6$  servings per day=6.0.

Vegetable intake was measured using an identical format and method to that used for fruit, and included intakes of all raw, cooked, frozen, canned, or dried vegetables and legumes, but excluded potatoes. One serving of vegetables was defined as  $\frac{1}{2}$  c cooked vegetables/beans, or 1 c salad vegetables. The test-retest reliability of F/V intake was assessed by weighted  $\kappa$  statistic in a separate sample ( $n=37$ ) who completed the same survey twice, 1

month apart. The  $\kappa$  coefficient was 0.54 for fruit intake and 0.65 for vegetable intake.

## Mediators

**Overall Take-Out Food Consumption.** Participants were asked how often they usually consumed take-out foods in the past 12 months (“never” to “once per day”). Similar to the F/V intake measures, responses were never=0, rarely=0.1, <1 time a month=0.2, one to three times per month=0.5, once per week=1.0, 2 to 3 times per week=3.0, five to six times per week=5.5, and once per day=7.0. The weighted  $\kappa$  coefficient for this measure was 0.71.

**“Less Healthy” and “Healthy” Take-Out Food-Types.** Participants who reported consuming take-out foods during the past 12 months ( $n=804$ ) were asked how often they usually ate each of 22 take-out foods, identified to be the most frequently consumed take-out foods in Australia (18). Similar to overall take-out food consumption, seven response options ranged from “never or rarely” to “once per day.”

Each of these 22 items was classified as either “less healthy” or “healthy” choices. Similar to a previous study (18), this classification was based on the Australian Guide to Healthy Eating (29), which categorizes foods into five groups: cereals, vegetables, fruit, dairy, and meat, and “extra” foods. The “extra” foods (eg, cakes and deep-fried take-out foods) are a nonessential part of a diet and are typically high in fat, salt, or sugar. Most of the “less healthy” take-out items were consistent with the “extra” foods. To classify foods not identified in the “extra” food list, nutrient composition data were used (30,31). Foods meeting one or more of the following criteria were classified as “less healthy”:  $>2,500$  kJ (597.5 kcal) energy per serving,  $>3$  g saturated fat, and  $<2$  g fiber per serving. Beverages classified as “less healthy” were those containing  $\geq 600$  kJ (143.4 kcal) energy per serving and/or  $>3$  g saturated fat per 100 g. Foods or beverages not meeting any of these criteria were considered “healthy” options. This classification resulted in 13 “less healthy” items and nine “healthy” items.

“Less healthy” take-out foods comprised: potato chips, hamburger, pizza, savory pies, fried fish/seafood, fried chicken, fried dim-sum, curry, cakes, non-diet soft drink, thick/milk shake, flavored milk, and ice cream. “Healthy” take-out foods comprised: kebab, sandwiches, fried rice, pasta, Asian-style noodles, sushi, salad, diet soft drink, and fruit/vegetable juices. A score was calculated to characterize each participant’s take-out food consumption as follows: never/rarely consumed the take-out item=0, consumed less than once a month=1, one to three times per month=2, four times per month=3, two to four times per week=4, five to six times per week=5, and once a day or more=6. “Less healthy” and “healthy” take-out food indexes were created by summing the items. Each respondent’s score was rescaled to range from 0 to 100. Higher scores were indicative of consuming a wider variety or greater frequency of consumption during the past 12 months. The weighted  $\kappa$  coefficients for “less healthy” take-out foods ranged from 0.34 to 0.66 (mean  $0.53 \pm 0.08$ ) and “healthy” items ranged from 0.17 to 0.71 (mean  $0.48 \pm 0.16$ ).

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