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Original Study

A Prospective Cohort Study to Examine the Association Between Dietary Patterns and Sarcopenia in Chinese Community-Dwelling Older People in Hong Kong

Ruth Chan PhD [a,*], Jason Leung MSc [b], Jean Woo MD [a]

[a] Department of Medicine and Therapeutics, The Chinese University of Hong Kong, Shatin, Hong Kong SAR
[b] Jockey Club Centre for Osteoporosis Care and Control, The Chinese University of Hong Kong, Shatin, Hong Kong SAR

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A B S T R A C T

Objectives: Dietary pattern analysis has recently emerged as an alternative approach to investigate the association between diet and sarcopenia. This study examined the association of dietary patterns with sarcopenia in Chinese community-dwelling older people.

Methods: Chinese men and women aged 65 years or older participating in a cohort study examining the risk factors for osteoporosis completed a validated food frequency questionnaire at baseline between 2001 and 2003. Adherence to a priori dietary patterns, namely the Diet Quality Index-International (DQI-I) and the Mediterranean Diet Score (MDS) was assessed. Factor analysis identified 3 a posterior dietary patterns: "vegetables-fruits," "snacks-drinks-milk products," and "meat-fish." Sarcopenia was defined using the Asian Working Group for Sarcopenia algorithm. Multiple logistic regression was used for cross-sectional analysis (n = 3957) to assess the associations between dietary patterns and prevalent sarcopenia, and for longitudinal analysis (n = 2948) on their associations with 4-year incident sarcopenia with adjustment for sociodemographic and lifestyle factors.

Results: There were 290 (7.3%) (185 men, 105 women) sarcopenic cases at baseline and 264 (9.0%) (160 men, 104 women) incident sarcopenic cases at the 4-year follow-up. At baseline, men in the highest quartile of DQI-I had reduced odds of sarcopenia (Adjusted OR 0.50, 95% CI 0.31–0.81, P_{trend} = .004) compared with men in the lowest quartile. Men in the highest quartile of "vegetables-fruits" pattern score (Adjusted OR 0.60, 95% CI 0.36–0.99, P_{trend} = .034) showed lower likelihood of sarcopenia compared with men in the lowest quartile. Higher quartile of "snacks-drinks-milk products" pattern score was associated with lower odds of sarcopenia in men (Adjusted OR 0.41, 95% CI 0.24–0.70, P_{trend} < .001). There was no association between dietary patterns and prevalent sarcopenia in women. None of the dietary patterns was associated with incident sarcopenia at 4-year in both sexes.

Conclusions: Higher DQI-I, higher "vegetables-fruits" dietary pattern score, and higher "snacks-drinks-milk products" dietary pattern score were associated with lower odds of prevalent sarcopenia in Chinese older men.

Aging is associated with changes in the body composition.[1] Sarcopenia represents the loss of skeletal muscle and strength that occurs with aging.[2] Using the definition of sarcopenia proposed by the European Working Group on Sarcopenia in Older People (EWGSOP), sarcopenia has been shown to affect 1% to 29% of older people living in the community and up to 68% for men living in residential care settings.[3] Accumulating evidence suggests that this condition is associated with many adverse health outcomes, such as falls, disability, institutionalization, mortality, and poor quality of life, thus its impact on health and social care costs is substantial.[4–6] Meanwhile, recent evidence reveals that this condition is potentially reversible,[7] therefore identifying ways to treat sarcopenia is of public health importance.

The pharmaceutical approach is considered as one of the approaches to treat sarcopenia, but this area of research is still at an early

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* Address correspondence to Ruth Chan, Rm 124021, 10/F Lui Che Woo Clinical Sciences Building, Prince of Wales Hospital, Shatin, Hong Kong SAR.
E-mail address: ruthchansm@cuhk.edu.hk (R. Chan).

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stage.[8] In contrast, evidence on nonpharmaceutical approaches regarding the role of nutritional supplementation and exercise programs, either individually or in combination, in the treatment of sarcopenia is accumulating.[9,10] Findings from past studies also reveal that diet may be one of the potential modifiable factors to delay the onset of sarcopenia. A diet rich in protein, vitamins, and antioxidants is suggested to be beneficial for preventing or slowing down this age-related decline in muscle mass and strength.[11–16] However, most previous studies focused on using a single nutrient or food group approach to investigate the association between individual nutrient or food group and sarcopenia, and this approach may not be able to take into account the interaction of various nutrients and food groups in the whole diet.[17,18] Therefore, a dietary pattern approach has recently been considered as an alternative approach to relate diet to sarcopenia.

To our knowledge, only 2 observational studies[19,20] have been conducted to examine the association between dietary patterns and sarcopenia. Both studies were, however, cross sectional in nature and were conducted in a white population. In view of the scarcity of evidence on this topic and the fact that Chinese diets are different from Western diets, the present study aimed to conduct both cross-sectional analysis and prospective incident analysis to examine the relationship of a priori and a posterior diet patterns with prevalent and incident sarcopenia in Chinese community-dwelling older people in Hong Kong.

Materials and Methods

Study Population

This was a prospective cohort study. Details of this cohort study have been described previously.[21] In brief, participants were 2000 Chinese men and 2000 Chinese women aged 65 years or older living in the community. They were recruited on a voluntary basis in a health survey between August 2001 and December 2003. They were able to walk or take public transport to the study site and were recruited using a stratified sampling method so that approximately 33% would be in each of these age groups: 65 to 69, 70 to 74, and 75+. Participants attended the 4-year follow-up between August 2005 and November 2007. Mean (SD) follow-up year was 3.9 (0.1) years. This study was conducted in accordance with the Declaration of Helsinki. This study was approved by the Clinical Research Ethics Committee of the Chinese University of Hong Kong. All participants provided written informed consent. We excluded participants with incomplete or invalid dietary or demographic data or extreme energy intake at baseline for cross-sectional analysis and further excluded those had sarcopenia at baseline and did not attend 4-year follow-up for the 4-year prospective incident analysis. The final sample size for the cross-sectional and prospective analyses were 3957 and 2948, respectively.

Questionnaire

A structured interview was conducted to capture information on demographics, lifestyle, and past health. Information on the duration and level of past and current use of cigarettes, cigars, and pipes was obtained. Smoking status was categorized into former smoking (at least 100 cigarettes smoked in a lifetime), current smoking, or never smoking. Alcohol use was also asked and drinking status was defined as never, former, or current. Current drinkers were defined as those who consumed at least 12 drinks of beer, wine (including Chinese wine), or liquor over the previous 12 months. Self-reported medical history was collected at baseline based on participants' report of their physician's diagnoses, supplemented by the identification of drugs brought to the interviewers. Depressive symptoms were evaluated using the Geriatric Depression Scale[22] with a score of 8 or more representing depressive symptoms, validated in elderly Chinese individuals.[23] Cognitive function was assessed using the Cognitive Screening Instrument for Dementia (CSID) with a cutoff value for probable or borderline dementia of 29.5 or below.[24] Physical activity level was assessed using the Physical Activity Scale of the Elderly (PASE).[25] It is a 12-item scale measuring the average number of hours per day spent in leisure, household, and occupational physical activities over the previous 7 days. A higher score indicates higher physical activity level.

Dietary Assessment

Dietary intake was assessed at baseline using a validated semi-quantitative food frequency questionnaire (FFQ).[26] A trained interviewer asked each participant to report the frequency and the usual amount of consumption of each food item over the past year. Portion size was explained to participants using a catalogue of pictures of individual food portions. Daily amount of main food groups consumed, including cereals, egg and egg products, fish and shellfish, fruits and dried fruits, legumes/nuts/seeds, meat and poultry, milk and milk products, and vegetables was calculated. Mean nutrient quantitation per day was calculated using food tables derived from McCance and Widdowson[27] and the Chinese Medical Sciences Institute.[28]

A Priori and A Posterior Dietary Pattern Scores

The Dietary Quality Index-International (DQI-I) was calculated according to the method described by Kim et al[29] and details have been described elsewhere.[30] In brief, 4 major aspects of the diet are assessed in the index, including variety, adequacy, moderation and overall balance. The DQI-I total score ranges from 0 to 94 and higher score indicates better diet quality. A Mediterranean Diet Score (MDS) was used to assess the adherence to the Mediterranean diet and it was calculated using the revised method described by Trichopoulou et al.[31] Details of its calculation have been reported previously.[32] The total MDS ranges from 0 (minimal adherence) to 9 (maximal adherence).

Details of dietary pattern scores derived by the factor analysis have been described elsewhere.[33] In brief, each food item in the FFQ were aggregated into 32 food groups according to the similarity of food type and nutrient composition. The food groups were then energy adjusted, in which the energy intake from each food group was divided by total energy intake and multiplied by 100, and were expressed as percentage contribution to total energy.[34] Factor analysis was performed with varimax rotation using the 32 food groups.[17] Factors were retained based on an eigenvalues greater than 1.0, a scree plot, and the interpretability.[35] The factor score for each pattern was then calculated for each participant through summing intakes of food items weighted by their factor loadings. A higher score represented greater conformity with the derived pattern. Three dietary patterns were identified in the present study, namely "vegetables-fruits," "snacks-drinks-milk products," and "meat-fish" (Table 1).[33]

Physical Measurements

Body weight was measured with participants wearing a light gown, using the Physician Balance Beam Scale (Healthometer, Alsip, IL). Height was measured using the Holtain Harpenden stadiometer (Holtain Ltd, Crosswell, UK). Body mass index (BMI) was calculated as (body weight in kg/[height in m]^2). Body composition at baseline and the 4-year follow-up were measured using dual-energy X-ray absorptiometry (DEXA) (Hologic QDR-4500W, software version 11.2; Hologic, Inc., Waltham, MA). Total appendicular skeletal muscle mass (ASM) was calculated by the sum of lean mass measured in the 4 limbs, with the operator adjusting the cut lines of the limbs according to specific anatomical landmarks as described by Heymsfield et al.[36] Grip strength was measured using a dynamometer (JAMAR Hand