CORE
Metadata, citation and similar papers at core.ac.uk
Provided by Bournemouth University Research Online

Title page

Effects of lunch club attendance on the dietary intake of older adults in the UK: a pilot cross-sectional study.

Running Title: Lunch-clubs and dietary intake of older people.

Fotini Tsofliou,[1] Maria G. Grammatikopoulou,[2,3,*], Rosie Lumley,[1] Konstantinos Gkiouras,[2,3] Jose Lara,[4] Carol Clark[1]

[1] *Department of Rehabilitation and Sport Sciences, Bournemouth University, Bournemouth, BH1 3LT, UK;* [2] *Department of Nutrition & Dietetics, Alexander Technological Educational Institute, Thessaloniki, Greece;* [3] *Department of Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece; and* [4] *Department of Applied Sciences, Northumbria University, Newcastle upon Tyne, NE1 8ST, UK.*

[*] During the time of the study, M.G.G. was a visiting scholar at University of Bournemouth, funded by the Erasmus program.

Author Information: F. Tsofliou, PhD, Senior Lecturer; M.G. Grammatikopoulou, PhD, Senior Lecturer; R. Lumpley, MSc, Research Associate; K. Gkiouras, MSc, Research Associate; J. Lara, PhD, Senior Lecturer; C. Clark, PhD, Professor.

Correspondence: Fotini Tsofliou, Department of Rehabilitation and Sport Sciences, Bournemouth University, Bournemouth, BH1 3LT, UK. Email: ftsofliou@bournemouth.ac.uk; Tel.: +44 1202 961583.

Author contributions: F.T. (corresponding author) conceived the idea and designed the study. M.G.G. prepared the first draft of the manuscript, which was adapted by F.T. R.L. collected all data, analysed the dietary data and drafted part of the methodology. K.G. performed all statistical analyses and drafted the results. J.L. and C.C. edited and revised study procedures. F.T. was responsible for the final content of the paper and all authors have read and approved the final manuscript.

Conflicts of interest: The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding source: The present study did not receive any funding, however, during the study, M.G.G. was a visiting scholar at Bournemouth University, funded by the Erasmus program.

Ethical permission: Bournemouth University. Ethics checklist ID 11511

Abstract

Background: Lunch clubs are community-based projects where meals are offered with opportunities for social interaction, and a unique dining experience of dual commercial and communal nature.

Aim: The aim of the present cross-sectional study was to assess differences in the dietary intake between lunch club and non-lunch club days among community-dwelling elderly, living in [removed for blind peer review].UK.

Methods: A total of 39 elderly individuals attending local lunch clubs, were recruited. Socioeconomic factors were recorded, anthropometric measurements were taken and the dietary intake was assessed in lunch-clubs and non-lunch club days via 24h dietary recalls.

Results: For the majority of participants, having a hot meal (74.4%), meeting with friends (92.3%) , dining outside home (76.9%) , having a home-styled cooked meal (71.8%), and skipping cooking (43.6%) were considered as important factors for lunch club dining. Absolute intake energy, protein, fat, carbohydrate, saturated fatty acids (SFA), fiber, potassium, calcium, iron, vitamins A, C and folate, as well as water from drinks were significantly greater among lunch club days. When intake was expressed as a % of the reference values, all examined nutrients were consumed in greater adequacy during lunch club days, except from potassium and vitamin D.

Conclusions: Lunch clubs appear to be an effective means for ameliorating nutrient intake among older adults, while in parallel, offer the opportunity for socializing and sharing a hot meal with peers.

Keywords: dietary survey; older people; ageing, social dining; community meals, cooked hot meal.

Introduction

During the last decades, the elderly population appears to grow faster than any other age group (Stokes and Preston, 2013). With increased morbidity characterizing older age (Shlisky *et al.*, 2017; Kingston *et al.*, 2018), this substantial increase in longevity is hallmarked by a need to promote healthier ageing (Marsman *et al.*, 2018; Grammatikopoulou *et al.*, 2019). On the other hand, nutritional status and in particular malnutrition, appears to be a pivotal health effector among elderly, triggering the development of several health issues (Shlisky *et al.*, 2017), while in parallel, increasing mortality risk.

A high proportion of elder individuals are malnourished (Grammatikopoulou *et al.*, 2019), mainly as a result of altered nutritional needs, decreased appetite, chewing problems, sensory decline, food insecurity, social isolation, and poor psychological health (Feldblum *et al.*, 2007; Grammatikopoulou *et al.*, 2012; Agarwal *et al.*, 2013; Clegg and Williams, 2018). Therefore, developing effective interventions to tackle malnutrition among older adults is an important public heal priority. Community-based projects such as lunch clubs are a fairly recent approach in the U.K. and other countries (Brunet, 1987). Lunch clubs are community places where meals are offered in a social setting such as a day centre, or a village hall. They are delivered by community, faith or charitable groups, meeting on average once a week and recruiting participants via word of mouth, advertising or referral from health and social care professionals. Apart from a healthy meal, lunch clubs also offer opportunities for social interaction, and a unique dining experience of dual commercial and communal nature (Thomas and Emond, 2017).

Despite the importance of lunch clubs in improving the psychology of elderly (Corcoran, Over and Withrow, 2010; Thomas and Emond, 2017), we lack data concerning their effect on the dietary intake. Limited research suggests that regular attendance to lunch clubs can increase compliance with the recommendations for key nutrients intake, including calcium, iron, folate and vitamin D (Burke *et al.*, 2011). Given that elderly malnutrition is also associated with lower income tiers (Donini *et al.*, 2013), lunch clubs could also form as a means for improving dietary intake. Based on this hypothesis, the present pilot cross-sectional study was designed, aiming to compare dietary intake between lunch club and non-lunch club days, among elderly in the U.K.

Methods

The present cross-sectional study was carried out at lunch clubs in [removed for blind peer review] U.K., between November and January 2015 – 2016. Lunch clubs with a target audience of attendees over 65 years old, were approached with details of the study. Once agreed, a mutually convenient date was arranged for the researcher to visit on the day of a lunch. Five lunch clubs in total were visited in the [removed for blind peer review].area. Participants were recruited from these clubs on a convenience sampling basis, with the only criteria being 1) age greater than 65 years old, 2) attending a lunch club at least once per week, 3) being able to communicate effectively in the English language, and 4) willing to participate. In further detail, ten older adults were recruited from [removed for blind peer review], twelve from [removed for blind peer review], six from the [removed for blind peer review], five from the [removed for blind peer review] and seven from the [removed for blind peer review]. A total of 40 participants were recruited, but the final sample included 39 elderly with complete data. All participants were provided with an information letter, a consent form and a questionnaire, making it clear that they could withdraw at any point. The study was approved by [removed for blind peer review] , ethics checklist ID 11511. Written informed consent was obtained from all participants prior to participation. The study followed the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines for cross-sectional studies (Supplementary file).

The questionnaire was designed specifically for this project and standardised with pilot testing to be used in more than one location. It was piloted twice on three older adults who were willing to take part on the preliminary phase of the questionnaire's development. Subsequently, modifications were performed including transposing all responses in a Likert scale or closed question tick boxes with an additional option for those opting exclusion from the answer, for increased easiness and accuracy. Questions included length and frequency of lunch club attendance, meal enjoyment, reasons for attending and participants' perceived influence of dinning in the clubs, on their dietary habits.

Anthropometric measurements included height, weight, waist circumference and hand grip strength. Due to the season (winter) and the variety of participants' mobility issues, it was safer to complete the weight and height measurements with shoes and one layer of top clothing on. Additionally, Body Mass Index (BMI) was calculated and body fat, as a percentage of body weight, was estimated with the Lean *et al*. (Lean, Han and Deurenberg, 1996) method.

Self-reported food intake was assessed using three 24h dietary recalls. This was taken on the day of the interview (including their breakfast, lunch club meal and what they anticipated eating for the rest of the day) and two recent days that they were not at a lunch club. Validity of self-reporting has been suggested to decrease with age (Ortiz-Andrellucchi *et al.*, 2009) due to memory loss, impairments such as hearing difficulties with the overweight elderly tending towards under-reporting energy and unhealthy food (Cade and Hutchinson, 2015). In order to obtain as much accuracy as possible, several measures were taken. To aid dietary recall, the researcher led recovery of missed food items and preparation methods by providing assistance with writing, particularly in the case of hearing or sight problems. In further detail, a structured dietary recall was used to provide helpful prompts, in addition to visual aids, similar in size and shape to anticipated portions of a ruler, to better estimate solid foods. These props were consistent at all clubs and helped to refine estimations of portion sizes.

NetWisp version 4.0 dietary software (Tinuviel Software Ltd., U.K.) was used to analyse the 39 completed dietary recalls. Micronutrient intake was compared to the dietary reference values (DRVs), (Great Britain. Department of Health. and Panel on Dietary reference Values of the Committee on Medical Aspects of Food Policy., 1991) while the energy and carbohydrate intake were compared to the estimated average requirements (EAR), (The Scientific Advisory Committee on Nutrition recommendations on the DRVs for energy, 2011; The Scientific Advisory Committee on Nutrition recommendations on carbohydrates including sugars and fibre, 2015) and water from drinks, based on the British Dietetic Association guidelines (British Dietetic Association, 2017).

Data is presented as means ± standard deviations (SD) for normally-distributed variables or medians with their interquartile range (IQR) for non-normal variables and frequencies/percentages for categorical variables. Normality was assessed with the Shapiro-Wilk test. Independent t-tests assessed differences in age and anthropometric characteristics between the genders. Fisher's exact tests was used to compare categorical variables. Differences in nutrient intake between lunch club and non-lunch club days were assessed with paired t-test or Wilcoxon signed rank tests when the assumption of normality was violated. Multivariable linear regression models tested the relationship among the difference (Δ) in nutrient intake between lunch club and non-lunch club days (dependent variables) and male sex, age (continuous) and being married (independent variables), and were adjusted for non-lunch club days' nutrients (continuous) (regression to the mean) (Barnett, van der Pols and Dobson, 2004). All analyses were conducted on SPSS version 23.0 (IBM, SPSS Inc., Chicago, IL, USA) and STATA 12.0 (Stata Corp, College Station, Texas, USA), and the significance level was set at α=0.05.

Results

The sample was comprised of 39 individuals with a mean age of 82.1 (SD 8.2) years, and no difference in the gender distribution (43.6% male *versus* 56.4% female, P=0.423). Overall, participants were overweight (BMI 27.4 (SD 4.3) (kg/m^2), abdominally obese (waist circumference (100.2 (SD 12.7) cm), with low hand-grip strength 18.0 (SD 6.4) kg. Table 1 stresses the sample's characteristics and between-genders tests of differences. Men were taller and heavier than women (P=0.006, and P<0.001), and demonstrated a stronger hand grip strength (P<0.001), however the two genders did not differ in BMI, waist circumference, or body fat (all P>0.05).

Reasons for lunch club attendance, proximity to the lunch clubs, attendance duration and means of transport to and from the clubs, are also detailed in **Table 1**. The majority of participants reported that having a hot meal (74.4%), meeting with friends (92.3%), dining outside home (76.9%) , having a home-styled cooked meal (71.8%), and skipping cooking (43.6%), were perceived as important factors in relation to their lunch club dining experience . Meal affordability and participating in the activities offered at the lunch clubs were not deemed as important factors among elderly. The majority of participants had been attending lunch clubs for more than a year and had chosen lunch clubs distanced less than a mile from their home (84.6% and 71.8% of participants respectively). Transportation to the lunch clubs was performed by vehicle from most of the elderly**.**

Table 2 compares the dietary intake of participants between lunch club and non-lunch club days. In terms of absolute intake energy, protein, fat, carbohydrate, saturated fatty acids (SFA), fiber, potassium, calcium, iron, vitamins A, C and folate, as well as water from drinks were significantly greater among lunch club days. When intake was expressed as a % of the DRV, all examined nutrients were consumed in greater adequacy during lunch club days, except from potassium and vitamin D.

Male sex, age and being married did not have a significant relationship with the difference (Δ) of energy, total protein and fat, or SFA, intake between lunch club and non-lunch club days in multivariable linear regression models (**Table 3**). However, it was observed that being married had a significant, positive relationship with Δ carbohydrate intake, expressed as a % of the total daily energy consumption (ß =9.26, 95% CI=1.62 to 16.91, P=0.019). When the models were repeated for the micronutrients intake only age had a positive relationship with the Δ sodium intake (ß =74.78, 95% CI=3.43 to 146.12, P=0.040). Finally, being married had a positive relationship with the Δ %DRV water intake (ß =10.59, 95% CI=0.89 to 20.28, P=0.033).

Discussion

The present study reveals that the dietary intake of elderly is substantially improved on the days when dining at lunch clubs. In particular, energy, and macronutrient intake, as well as the consumption of several micronutrients is greater during the lunch club days compared to the non-lunch club days. Additionally, being married was associated with increased carbohydrate and water consumption on lunch club, compared to non-lunch club days.

The positive effect of lunch clubs on improving dietary intake and quality in the elderly appears to stem from two main factors being, improved psychology and ameliorated diet quality. Research has showed that dining with company increases both the intake of key nutrients and the appetites of those living alone (Vesnaver and Keller, 2011; Conklin *et al.*, 2014). The community spirit, social support, social network and reduction in social isolation has recently been highlighted by older people as a pivotal factor for affecting diet quality (McIntosh, Shifflett and Picou, 1989; Bloom *et al.*, 2016, 2017). In addition, the elderly perceive lunch clubs as an opportunity to reduce the feeling of loneliness (Thomas and Emond, 2017). In this context, lunch clubs have been shown to negate some of the psychological effects caused by social isolation, including depression, poor cognitive performance and low perceived health status (Thomas, 2015). In a qualitative study (Thomas and Emond, 2017), older people reported lunch club dining as an out of routine procedure, while dining in and alone as being the commonest everyday method of dining.

As far as diet quality is concerned, lunch clubs provide older people with regular shared meals, and a wider variety of food compared to their norm (Thomas and Emond, 2017). This previous finding may explain the increased dietary intakes and quality of nutrients that were noted amongst participants attending lunch clubs in this study. In addition the elderly consider lunch clubs meals as appetizing, and perceive the experience as a "treat" (Thomas and Emond, 2017).

In our study, there were no differences in dietary intake between age and gender on lunch club and non-lunch club days. However, it was observed that there was a significant increase in carbohydrate and fluid intake among married elderly on lunch club days. Overall, literature indicates that being married is associated with increased dietary intake during older age (Horwath, 1989; McIntosh, Shifflett and Picou, 1989). While widowhood is associated with increased depressive symptoms and a less-enjoyment of meals which may lead to reduced dietary intake and quality (Vesnaver *et al.*, 2015, 2016). Thus, it is highly likely that the improved intake of married elderly is further increased on lunch club days.

Caveats of the present research include its pilot nature, allowing for a relatively small, although homogenous sample of participants. Additionally, the cross-sectional nature of the design does not allow for a prospective understanding of the effects of lunch club dining on the dietary intake and health of elderly. Future research should aim in recruiting more participants and evaluating the psychological status of elderly, as well as compare the diet quality of lunch club meals compared to those eaten at home.

To summarize, the present pilot study shows that lunch club dining is associated with increased dietary intake and nutrient quality among older people. This finding is important for stakeholders and policy makers in supporting better dietary intake among community-dwelling older people.

Availability of data: Due to the personal nature of the data, they will be available blinded, upon request.

Acknowledgements: The authors appreciate the cooperation of all participants.

Declaration of Conflicts of interest: The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding: The present study did not receive any funding, however, during the study, [removed for blind peer review].was a visiting scholar at [removed for blind peer review]., funded by the Erasmus program.

Author contributions: [removed for blind peer review], (corresponding author) conceived the idea and designed the study. [removed for blind peer review], prepared the first draft of the manuscript, which was adapted by [removed for blind peer review]. [removed for blind peer review]collected all data, analysed the dietary data and drafted part of the methodology. [removed for blind peer review], performed all statistical analyses and drafted the results. [removed for blind peer review], and [removed for blind peer review], edited and revised study procedures. [removed for blind peer review],. was responsible for the final content of the paper and all authors have read and approved the final manuscript.

References

Agarwal, E. *et al.* (2013) 'Malnutrition in the elderly: A narrative review', *Maturitas*, 76, pp. 296–302. doi: 10.1016/j.maturitas.2013.07.013.

Barnett, A. G., van der Pols, J. C. and Dobson, A. J. (2004) 'Regression to the mean: what it is and how to deal with it', *International Journal of Epidemiology*. Oxford University Press, 34(1), pp. 215–220. doi: 10.1093/ije/dyh299.

Bloom, I. *et al.* (2016) 'Influences on diet quality in older age: the importance of social factors', *Age and Ageing*, 46(2), pp. 277–283. doi: 10.1093/ageing/afw180.

Bloom, I. *et al.* (2017) 'What influences diet quality in older people? A qualitative study among community-dwelling older adults from the Hertfordshire Cohort Study, UK', *Public Health Nutrition*, 20(15), pp. 2685–2693. doi: 10.1017/S1368980017001203.

British Dietetic Association (2017) *Food Fact Sheets: Fluids*. London, U.K. Available at: https://www.bda.uk.com/foodfacts/fluid.pdf (Accessed: 25 February 2019).

Brunet, D. (1987) 'Lunch clubs for the elderly in England: a study.', *Canadian family physician Medecin de famille canadien*, 33, pp. 1299–306.

Burke, D. *et al.* (2011) 'Community luncheon clubs benefit the nutritional and social well-being of free living older people', *Journal of Human Nutrition and Dietetics*. Wiley/Blackwell (10.1111), 24(3), pp. 278–278. doi: 10.1111/j.1365-277X.2011.01175_2.x.

Cade, J. and Hutchinson, J. (2015) 'Study Design: Population-Based Studies', in *Nutrition Research Methodologies*. Chichester, UK: John Wiley & Sons, Ltd, pp. 13–27. doi: 10.1002/9781119180425.ch2.

Clegg, M. E. and Williams, E. A. (2018) 'Optimizing nutrition in older people', *Maturitas*, 112, pp. 34–38. doi: 10.1016/j.maturitas.2018.04.001.

Conklin, A. I. *et al.* (2014) 'Social relationships and healthful dietary behaviour: evidence from over-50s in the EPIC cohort, UK.', *Social Science & Medicine*. Elsevier, 100(100), pp. 167–75. doi: 10.1016/j.socscimed.2013.08.018.

Corcoran, I., Over, R. and Withrow, A. (2010) *Proving the Social and Economic Value of the Lunch Club for Older Persons*. Worcester, UK.

Donini, L. M. *et al.* (2013) 'Malnutrition in elderly: Social and economic determinants', *The journal of nutrition, health & aging*, 17(1), pp. 9–15. doi: 10.1007/s12603-012-0374-8.

Feldblum, I. *et al.* (2007) 'Characteristics of undernourished older medical patients and the identification of predictors for undernutrition status', *Nutrition Journal*, 6(1), p. 37. doi: 10.1186/1475-2891-6-37.

Grammatikopoulou, M. *et al.* (2012) 'Food Insecurity among elderly in Athens', *Clinical Nutrition*, S7, p. 46.

Grammatikopoulou, M. G. *et al.* (2019) 'Food insecurity increases the risk of malnutrition among community-dwelling older adults', *Maturitas*, 119, pp. 8–13. doi: 10.1016/j.maturitas.2018.10.009.

Great Britain. Department of Health. and Panel on Dietary reference Values of the Committee on Medical Aspects of Food Policy. (1991) *Dietary reference values for food energy and nutrients for the United Kingdom : Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy*. H.M.S.O.

Horwath, C. C. (1989) 'Marriage and diet in elderly Australians: results from a large random survey', *Journal of*

Human Nutrition and Dietetics. Wiley/Blackwell (10.1111), 2(3), pp. 185–193. doi: 10.1111/j.1365-277X.1989.tb00023.x.

Kingston, A. *et al.* (2018) 'Projections of multi-morbidity in the older population in England to 2035: estimates from the Population Ageing and Care Simulation (PACSim) model', *Age and Ageing*, 47(3), pp. 374–380. doi: 10.1093/ageing/afx201.

Lean, M. E., Han, T. S. and Deurenberg, P. (1996) 'Predicting body composition by densitometry from simple anthropometric measurements', *The American Journal of Clinical Nutrition*, 63(1), pp. 4–14. doi: 10.1093/ajcn/63.1.4.

Marsman, D. *et al.* (2018) 'Healthy ageing: the natural consequences of good nutrition—a conference report', *European Journal of Nutrition*, 57(S2), pp. 15–34. doi: 10.1007/s00394-018-1723-0.

McIntosh, W. A., Shifflett, P. A. and Picou, J. S. (1989) 'Social Support, Stressful Events, Strain, Dietary Intake, and the Elderly', *Medical Care*. Lippincott Williams & Wilkins, pp. 140–153. doi: 10.2307/3765138.

Ortiz-Andrellucchi, A. *et al.* (2009) 'Dietary assessment methods for micronutrient intake in elderly people: a systematic review', *British Journal of Nutrition*, 102(S1), p. S118. doi: 10.1017/S0007114509993175.

Shlisky, J. *et al.* (2017) 'Nutritional Considerations for Healthy Aging and Reduction in Age-Related Chronic Disease.', *Advances in nutrition (Bethesda, Md.)*, 8(1), pp. 17–26. doi: 10.3945/an.116.013474.

Stokes, A. and Preston, S. H. (2013) 'Population Change among the Elderly: International Patterns.', *Population and development review*. NIH Public Access, 38(Suppl 1), pp. 309–321. doi: 10.1111/j.1728-4457.2013.00566.x.

The Scientific Advisory Committee on Nutrition recommendations on carbohydrates including sugars and fibre (2015) *Independent report. SACN Carbohydrates and Health Report*. London, U.K.

The Scientific Advisory Committee on Nutrition recommendations on the DRVs for energy (2011) *Independent report. SACN Dietary Reference Values for Energy*. London, U.K.

Thomas, J. (2015) *Insights into loneliness, older people and well-being*. London, U.K.

Thomas, N. and Emond, R. (2017) 'Living alone but eating together: Exploring lunch clubs as a dining out experience', *Appetite*, 119, pp. 34–40. doi: 10.1016/j.appet.2017.03.003.

Vesnaver, E. *et al.* (2015) 'Food behavior change in late-life widowhood: A two-stage process', *Appetite*, 95, pp. 399–407. doi: 10.1016/j.appet.2015.07.027.

Vesnaver, E. *et al.* (2016) 'Alone at the Table: Food Behavior and the Loss of Commensality in Widowhood: Table 1.', *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 71(6), pp. 1059–1069. doi: 10.1093/geronb/gbv103.

Vesnaver, E. and Keller, H. H. (2011) 'Social Influences and Eating Behavior in Later Life: A Review', *Journal of Nutrition in Gerontology and Geriatrics*, 30(1), pp. 2–23. doi: 10.1080/01639366.2011.545038.

Table 1. Participant characteristics of older people attending lunch clubs (mean ± SD, or n and %)

	All (N=39)	Males (n=17)	Females (n=22)	Significance[a]
Age (years)	82.1±8.2	81.1±7.5	82.9± 8.8	0.504
Anthropometrics:				
Body weight (BW) (kg)	72.8±13.8	79.5±12.5	67.6±12.6	0.006
Height (cm)	162.9±9.9	171.2±5.8	156.4±7.2	<0.001
Body mass index (kg/m^2)	27.4± 4.3	27.2±4.7	27.5±4.1	0.836
Waist circumference (cm)	100.2± 12.7	104.6±12.6	96.8±12.1	0.057
Body Fat (% BW)	44.6±10.2	46.2±11.1	43.3±9.5	0.384
Hand grip strength (kg)	18.0±6.4	22.9±4.8	14.2±4.6	<0.001
Marital status:				
Married	8 (20.5%)	5 (29.4%)	3 (13.6%)	0.261
Other (single/divorcee/windowed)	31 (79.5%)	12 (70.6%)	19 (86.4%)	
Living arrangements:				
Alone	25 (64.1%)	9 (52.9%)	16 (72.7%)	0.314
With one or more adults [b]	14 (35.9%)	8 (47.1%)	6 (27.3%)	
Retirement status:				
Pension/savings/benefits	37 (94.9%)	15 (88.2%)	22 (100%)	0.184
Work income	2 (5.1%)	2 (11.8%)	0 (0%)	
Transportation means:				
By vehicle	25 (64.1%)	10 (58.8%)	15 (68.2%)	0.738
On foot	14 (35.9%)	7 (41.2%)	7 (31.8%)	
Residential proximity to the lunch club:				
Less than 1 mile	28 (71.8%)	13 (76.5%)	15 (68.2%)	0.725
More than 1 mile	11 (28.2%)	4 (23.5%)	7 (31.8%)	
Duration of attendance to lunch club:				
Less than 1 year	6 (15.4%)	1 (5.9%)	5 (22.7%)	0.206
More than 1 year	33 (84.6%)	16 (94.1%)	17 (77.3%)	
Reasons for lunch club attendance:	Important	Neither	Unimportant	
To have a hot meal	29 (74.4%)	7 (17.9%)	3 (7.7%)	
To meet with friends	36 (92.3%)	3 (7.7%)	0 (0.0%)	
To dine outside home	30 (76.9%)	8 (20.5%)	1 (2.6%)	
For a home-styled cooked meal	28 (71.8%)	5 (12.8%)	6 (15.4%)	
To skip cooking at home	17 (43.6%)	16 (41.0%)	6 (15.4%)	
For an affordable meal	15 (38.5%)	19 (48.7%)	5 (12.8%)	
For the extra activities	6 (15.4%)	28 (71.8%)	5 (12.8%)	

BW: Body Weight; SD: Standard Deviation;

[a] Significance values refer to either independent t-tests or Fisher's exact tests for continuous and categorical variables, respectively; [b] One female individual was in warden-controlled housing

Table 2. Dietary intake of participants at the day of lunch club and non-lunch club days (mean ± SD, or median with respective IQR) (N=39)

	Absolute Intakes		significance	% DRV[a]		Significance[b]
	Lunch club day	Non-lunch club days		Lunch club day	Non-lunch club days	
Energy (kcal)	1,850.1±483.9	1,367.3±516.8	<0.001	83.2 (28.0)	62.7 (26.0)	<0.001
Protein (g)	77.6±27.2	65.3±26.6	0.023	148.4 (92.0)	132.0±52.6	0.019
Protein (%)	17.0±4.9	19.3 (7.0)	0.021			
Total fat (g)	67.0 (31.0)	57.6±24.7	0.001			
Total fat (%)	37.2±8.6	38.0±10.0	0.702			
SFA (g)	26.0 (21.0)	23.3±10.6	0.037			
Total Carbohydrate (g)	205.0 (80.0)	147.0 (87.0)	<0.001			
Total Carbohydrate (%)	47.4±8.6	43.4±10.6	0.065			
Dietary Fibre (g)	12.0 (6.0)	9.0 (9.0)	0.013	41.0 (21.0)	31.0 (36.0)	0.031
Na (mg)	2,252.0 (1,387.0)	1,966.0 (1,452.0)	0.089	141.0 (87.0)	124.0 (81.0)	0.11
K (mg)	2,783.0 (1,225.0)	1,995.0 (1,129.0)	<0.001	80.0 (35.0)	58.0 (27.0)	<0.001
Ca (mg)	909.0±337.6	634.0 (353.0)	<0.001	129.7±48.3	90.0 (50.0)	<0.001
Fe (mg)	8.9 (5.0)	8.0 (7.0)	0.028	102.0 (53.0)	90.0 (77.0)	0.026
Vitamin A (μg)	1185.0 (1438.0)	865.0 (960.0)	0.020	202.7 (290.0)	123.6 (153.0)	0.015
Vitamin D (μg)	1.8 (2.0)	1.1 (1.0)	0.130	18.0 (18.0)	11.0 (14.0)	0.133
Folate (μg)	235.0 (173.0)	172.0 (116.0)	0.003	117.0 (87.0)	86.0 (58.0)	0.003
Vitamin C (μg)	73.0 (70.0)	33.0 (43.0)	0.002	183.0 (177.0)	80.0 (95.0)	0.002
Water from drinks (ml)	970.0 (400.0)	850.0 (437.0)	0.003	57.8 (24.0)	52.5 (28.0)	0.005

BDA: British Dietetic Association; DRV: Dietary Reference Values; EAR: Estimated Average Requirements; IQR: Interquartile range; SD: Standard Deviation; SFA: Saturated Fat Intake;

Table 3. Multivariable linear regression models[a] of the relationships among male sex, age, married status and the dietary intake difference between lunch club and non-lunch club days

DV/IV	Male sex ß, (95% CI), Significance	Age ß, (95% CI), Significance	Married ß, (95% CI), Significance
Δ Energy intake (EI)	38.30, (-156.73 to 233.33), P = 0.692	5.36, (-7.41 to 18.12), P = 0.400	45.65, (-222.85 to 314.14), P = 0.732
Δ Protein (g)	-4.34, (-22.74 to 14.07), P = 0.635	-0.15, (-1.39 to 1.09), P = 0.808	10.60, (-15.35 to 36.54), P = 0.412
Δ Protein (%DRV)	-0.46, (-3.81 to 2.88), P = 0.780	0.01, (-0.22 to 0.24), P = 0.936	-2.35, (-6.96 to 2.28), P = 0.310
Δ Total fat (g)	8.69, (-13.77 to 31.16), P = 0.437	-0.82, (-2.37 to 0.74), P = 0.292	-20.08, (-52.02 to 11.87), P = 0.210
Δ Fat (%EI)	4.59, (-1.44 to 10.61), P = 0.131	-0.01, (-0.41 to 0.39), P = 0.953	-4.91, (-13.01 to 3.19), P = 0.226
Δ SFA (g)	-0.11, (-10.62 to 10.39), P = 0.983	-0.52, (-1.24 to 0.20), P = 0.151	-8.39, (-22.80 to 6.02), P = 0.245
Δ Carbohydrate (g)	-4.95, (-44.10 to 34.21), P = 0.799	0.98, (-1.61 to 3.56), P = 0.447	52.63, (-2.22 to 107.48), P = 0.059
Δ Carbohydrate (%EI)	-4.65, (-10.27 to 0.97), P = 0.102	0.11, (-0.26 to 0.49), P = 0.540	9.26, (1.62 to 16.91), P = 0.019

Δ denotes the difference in nutrient intakes between lunch club and non-lunch club days; ß denotes linear regression beta coefficient;

CHO; Carbohydrates; CI; Confidence intervals; DRV: Dietary Reference Values; DV/IV; Dependent/Independent variables; EI: Energy Intake; SFA; Saturated fatty Acids.

[a] Multivariable linear regression models included differences in nutrient intakes as DV and IV were male sex, age (continuous), being married and were adjusted for non-lunch club days' nutrients (continuous)