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Meal Composition and Temporal Eating Patterns among Sri Lankan Adults: A Cross-sectional Study

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ABSTRACT

Background: Understanding population-specific food consumption patterns is useful for controlling diet-related health complications.
Objectives: This cross-sectional study aimed to identify the meal composition and timing of the meals among the public in Sri Lanka.
Materials & Methods: A nationally representative sample of adults was selected using a multi-stage random cluster sampling technique. Meal pattern data was derived from 24-hour dietary recalls.
Results: Almost all the surveyed respondents consumed three major meals, breakfast (97.6%), lunch (97.9%), and dinner (99.0%). Only 31.8% and 36.2% of the population had mid-morning and evening snacks, respectively. Vegetables were not consumed by 73.2%, 44.1%, and 58.2% of participants for breakfast, lunch, and dinner, respectively. Rice was the most common breakfast food item (67.7%), of which, 10% of participants consumed rice only with *'coconut sambol'.* Only 8.9%, 30.4%, and 11.8% of participants incorporated green leafy vegetables in their breakfast, lunch, and dinner in that order. Meat or meat equivalents were consumed by 28.8%, 60.8%, and 52.4% of participants for breakfast, lunch, and dinner, respectively. The most common snacks were biscuits/confectionaries and bakery foods. The time range between wake-up and breakfast was 00:30-07:00 hh: mm (Mean: 03:03 ± 1:17) while it was 00.15-05:45 hh: mm (Mean: 1:50 ± 0.56) between dinner and sleep onset.
Conclusions: The majority of the study population's meals are not deemed healthy and lack of variation in all dietary groups, including fruits, vegetables, dairy, meat or meat equivalents, and pulses. Biscuits, confectionaries, pastries, and other starchy foods were the most common snacks. There was a significant variation in meal timing among these groups.

INTRODUCTION

It is widely recognized that a nutritionally sound diet is fundamental to human health and well-being across the lifespan (WHO, 2009). A poor diet contributes to poor health and is a well-established, modifiable risk factor for the development of non-communicable diseases (NCDs), which are leading causes of global deaths (WHO, 2009). Over 80% of the global NCD deaths have occurred in low and middle-income countries (WHO, 2018). Sri Lanka is in the advanced phases of a demographic transition and is undergoing a fast epidemiological and nutritional revolution (De Silva, 2013). Regardless of micro-nutrient deficiencies, which are still reported in some parts of the country (World Bank, 2007), NCDs are emerging as the major diet-associated health concerns in Sri Lanka (Swarnamali, Jayasinghe and Katulanda, 2017). An increasing body of evidence has linked diet with the risk of developing NCDs, such as obesity, type 2 diabetes, cardiovascular diseases, and certain types of cancers (Cespedes and Hu, 2015). These conditions are aggravated by a range of various dietary risk factors such as low consumption of fruits and vegetables, and excess consumption of saturated fat, trans-fat, sugar, and salt (WHO, 2014).

Identification of dietary components that may play a role in the prevention of NCDs has become a major concern for researchers and public health authorities. People consume a combination of food components as meals rather than individual food components or nutrients. Hence, the recent approach in nutrition research is based on the identification and analysis of dietary or food consumption patterns of the general public (Cespedes and Hu, 2015). Dietary guidelines also focus on diet diversity with a high intake of fruits, vegetables, whole grains, and legumes; moderate intake of low-fat dairy and seafood; and low in processed meats, sugar-sweetened beverages, and refined grains (USDA, 2015). Therefore, it is important to evaluate the meal composition of adults in Sri Lanka to understand whether their food selection is health-promoting.

In addition to the above facts, irregularity of meal timing is now reported as another potential risk factor for metabolic syndrome, diabetes mellitus, and cardiovascular disease (Garaulet and Madrid, 2010). Besides, it has also been reported that late-night dinner is associated with obesity, metabolic syndrome, and hyperglycemia (Wang et al., 2013). This is because, glucose tolerance is reduced in the evening, from a combination of reduced glucose utilization, decreased insulin sensitivity, and low insulin secretion (Ruxton and Kirk, 1997). However, a lack of understanding of the timing of food consumption among Sri Lankan adults may lead to inappropriate management methods in the control of metabolic complications associated with meal timing. Therefore, the main objective of this cross-sectional study was to identify dietary patterns including meal composition and meal timing among the public in Sri Lanka.

MATERIALS & METHODS

Study sample

Participants for the present study were recruited based on the sample from the Sri Lanka Diabetes and Cardiovascular Study (SLDCS), a national study conducted between 2005 and 2006. In brief, the eligible respondents of this cross-sectional study were healthy Sri Lankan adults aged ≥ 18 years recruited from a sub-sample of a Sri Lanka Diabetes and Cardiovascular Study (Katulanda et al., 2008). In this study, a total of 500 subjects were selected representing all nine provinces using a multi-stage random cluster sampling technique consisting of 100 clusters according to the probability-proportional-to-size method, to gain a representative sample from the nine provinces. The sample was then stratified based on the area of residence and ethnicity. Those who were pregnant, lactating, acutely ill or on a therapeutic diet were excluded. Written informed consent for participation in

the study was obtained and ethical approval for this study was taken from the Ethics Review Committee, Faculty of Medicine, University of Colombo, Sri Lanka (EC/10/126). Details of the sample selection have been published previously (Jayawardena, Byrne, Soares, Katulanda and Hills, 2013).

Data collection procedure

An interviewer-administered questionnaire was used for data collection. Information relating to sociodemographic factors and the timing of daily routines (bedtime, wake-up time, and mealtime) was obtained. Bodyweight, height, and waist circumference were measured using standard protocols (WHO, 2017) and all these measurements were conducted by a trained staff member. Height was taken to the nearest 0.1 cm using a calibrated stadiometer (SECA GmbH & Co. KG, Hamburg, Germany). Body weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale (SECA GmbH & Co. KG, Hamburg, Germany). The standard formula, weight (kg) divided by height (m^2), was used to calculate the body mass index (BMI), and cut-offs were presented as recommended by WHO experts for Asian populations (WHO, 2004). Waist circumference was measured to the nearest 0.1 cm using a measuring tape.

Assessment of dietary intake

Dietary data were gathered using a 24 h dietary recall in direct chronological order. The intake of main meals (breakfast, lunch, and dinner) was divided into standard food groups such as cereal or equivalents (starchy foods), vegetables, pulses, meat or equivalents, green leafy vegetables, and fruits. Foods that were not considered in any of the above food groups were considered in the 'other' category. Details of the intake of drinks/beverages were also collected. The detailed methodology regarding the translation of food into the respective food groups is submitted in the supplementary file 1(https://nutritionsocietyofsrilanka.org/wp-content/uploads/2023/02/Supplementary-file..pdf). The timing of all meals was recorded. Dietary recalls were collected by two trained nutritionists who had received uniform training and adhered to the standard operating procedure (SOP). Dietary recalls of each participant were conducted by both data collectors separately. To minimize the inter-personal variation, at the end of the day the two interviewers reviewed each other's work and maintained homogeneity of the recording procedure. Where there was a disparity in the dietary recalls, participants were re-contacted for the second time and the 24h dietary recall was repeated on a different day.

Data analysis

Data were analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). Mean values with standard deviations (SD) and range were used to describe the study sample whereas, meal and sleep timing distributions were presented as mean ± SD and range (minimum and maximum values). The correlations between continuous variables were analyzed using Pearson correlation. The independent t-test was performed to determine the association between continuous variables. The significant association between variables was determined using inferential statistics based on a p-value of less than 0.05.

RESULTS

Table 1 summarizes the demographic characteristics of the study sample, meal timings, and circadian variables. The mean ± SD age of the population was 48.20 ± 14.62 years. The majority of the population was female (65.5%). Most of the study participant (35.8%) had a normal BMI, while 16% were found to be overweight, 34.4% were obese and 13.9% were underweight according to the WHO cut-off values for Asian populations. The mean ± SD of BMI was 22.87 ± 4.05 kg/m^2.

Table 1. Demographics, mealtime, sleep, and circadian characteristics of the participants

Parameter	n	Mean ± SD	Range
Age (years)	488	48.20 ± 14.62	18.0 - 89.0
BMI (kg/m^2)	489	22.87 ± 4.05	13.54 - 37.03
Waist circumference (cm)	488	78.81 ± 1.03	55.9 - 109.2
Sleep and circadian variables[†]			
Bedtime (hh:mm)	434	22:06 ± 0:58	19:00 - 02:00
Wake-up time (hh:mm)	482	05:15 ± 0:54	02:30 - 10:00
Sleep duration (hours)	433	07:05 ± 0:70	02:30 - 12:00
Mealtime[†]			
Wake-up drink (hh:mm)	451	06:04 ± 0:55	03:10 - 11:00
Breakfast (hh:mm)	474	08:17 ± 1:04	05:30 - 11:30
Lunch (hh:mm)	475	13:44 ± 0:58	11:00 - 17:30
Dinner (hh:mm)	474	20:18 ± 0:56	17:30 - 23:45
Time gap			
Breakfast-wake-up (hh:mm)	470	03:03 ± 1:17	00:30 - 07:00
Bedtime-dinner (hh:mm)	421	01:50 ± 0:56	00.15 - 05:45

[†]*24-hour clock time. MI = Body mass index, n = Sample size*

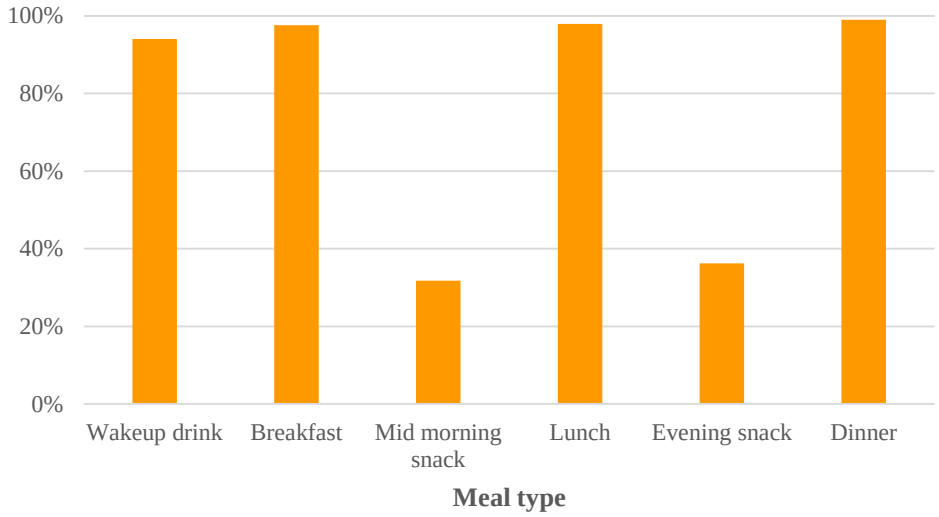

Figure 1. Consumption of meals by the participants on a given day

The meal timing, sleep and circadian variables are presented in Table 1.

Figure 1 depicts the percentage of the population that consumed three major meals (breakfast, lunch, and dinner), a wake-up drink, and in between two snacks. Almost all the participants had three main meals: breakfast (97.6%), lunch (97.9%), and dinner (99.0%).

In terms of proportion of the study sample who consumed a variety of wake-up drinks apart from water (considering the drinks which supplied substantial calories), full cream milk powder added tea (53.0%, n=256) was the most common wake-up drink and the second most common drink was 'plain tea' (tea without milk) (26.1%, n=126). A very small proportion of the population consumed fresh milk (2.1%, n=10). Moreover, only 16.3% (n=66) of the participants consumed a snack with wake-up drink and of which biscuit was the commonly consumed snack (12.1%, n=49) among them.

In terms of breakfast (n = 460); 2.4% (n = 11) of participants did not consume a breakfast. Starch-based breakfast was consumed by 96.3% (n = 443) of the sample while the rest of them had a pulse-based meal (1.3%, n = 6). Figure 2 has summarized an overview of the selection of different food options for their breakfast. Amongst starch-based food options, rice (69.9%, n=310) was the main choice and bread (11.3%, n=50) was the second option. When considering the consumption of vegetables, 73.2% (n=327) of respondents did not consume any form of vegetable for their breakfast. The proportion of people who obtained meat or meat equivalents for their breakfast was 28.8 %(n=128). Among them, dried fish/sprats (15.5%, n=69) and fish (7.7%, n=34) were found to be the most common items while a few of them consumed eggs (3.2%, n=14) and chicken (1.6%, n=7). Nine-tenths of participants (91.1%, n=409) did not add any green leafy vegetables for their breakfast. Nearly half of the study sample (48.0%, n=232) incorporated pulses for their primary starch-based breakfast, and dhal (32.8%, n=151) was the main type of pulse used by them. Only 11.9% (n=49) of them added fruits for their breakfast, from which banana was the most common fruit type (10.2%, n=42). Approximately a quarter of the population (24.3%, n=118) consumed *'coconut sambol'*, and 10.6% (n=51) of them consumed only the *'coconut sambol'* with rice or string hoppers without adding anything from other food groups.

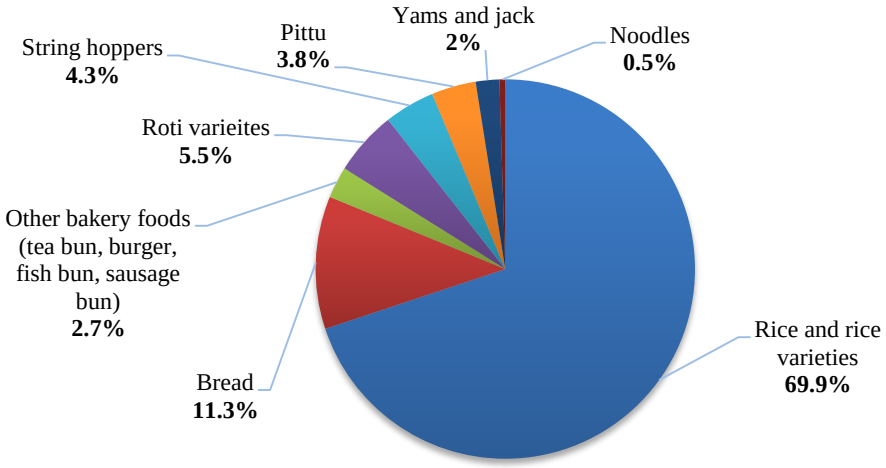

Figure 2. Breakfast meal options of the participants

Of the participants who consumed any kind of mid-morning drink (47.4%, n=229), almost all had 'plain tea' (46.1%, n=223). Nearly one-third of the population (31.8%, n=153) added some sort of snack along with the above drinks. Moreover, biscuits and confectionaries were the most common type of snacks (15.8%, n=76), while starch-based bakery foods were the second most common snack (12.9%, n=62). Only 2.8% (n=14) and 0.4% (n=2) consumed fruits and dairy products as mid-morning snack, respectively. In relation to lunch, rice with curies was the most common meal type (97%, n=460). The rest of the population (3%, n=14) consumed bread or biscuits, or other bakery foods as lunch. Nearly half of the participants (44.1%, n=209) did not consume any vegetables for their lunch. There were 60.8% (n=288) of participants who consumed any meat or equivalent for their lunch. According to Figure 3 majority of the participants obtained dried fish/sprats (25.3%, n=120) and fish (23.2%, n=110) as

meat or equivalent. Nearly half of the study sample (46.3%, n=224) added pulses to their lunch, with dhal being the most consuming pulse type (40.5%, n=196). Green leafy vegetables were consumed by 30.4% (n=147) of the respondents for their lunch, while fruits were consumed by only 15.7% (n=76).

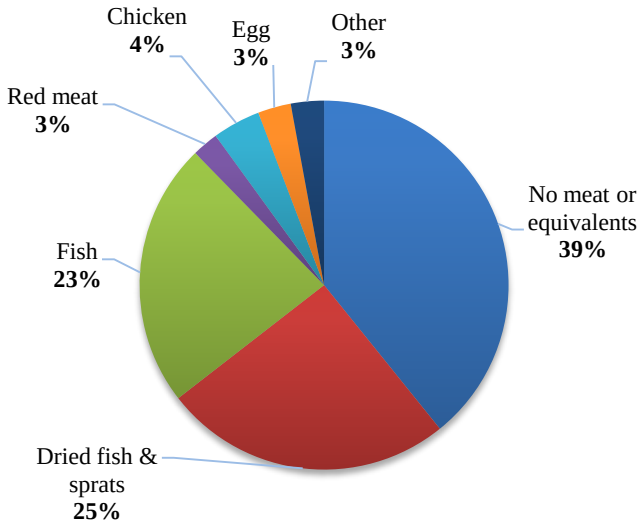

Figure 3. Consumption of meat or equivalents during lunch

Snacking behaviour during the evening is summarized in Figure 4. Of the participants who consumed any type of evening drink (77.9%, n=376), the majority of them consumed *'plain tea'* (49.4%, n=238) while 24.6% of them consumed full cream milk powder added tea (n=119). Biscuits (18.4%, n=89) or sweets (6.5%, n=32) or *'short eats'* (4%, n= 19) were first, second and third most common options for evening snack respectively while fruits were consumed only by 4.3% (n=21) of participants.

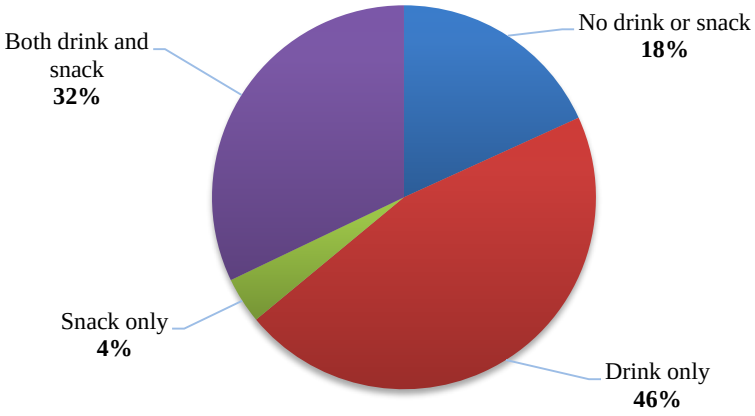

Figure 4. Snacking behavior in the evening

Considering the dinner (n=482); rice or rice-based recipes (79.3%, n=382) was the most common option while the rest of the participants consumed bread and other bakery foods (6.6%, n=32), *'pittu'* (5.2%, n=25), string hoppers (4.8%, n=23), 'roti' (2.3%, n=11) noodles and *'kottu'* (1.4%, n=7) and another type of starchy foods

(0.4%, n=2). Thirty percent (n=146) of the participants added a second starchy food, while 6.6% (n=31) included a third starchy food in addition to rice as the primary starchy food. More than half of the study sample (58.2%, n=276) did not eat any vegetables at dinner. Participants who consumed meat or equivalents (52.4 %, n=253) mostly had dried fish/sprats (21.9%, n=106) or fish (17.8%, n=86), while only 5.4% (n=26) consumed chicken, 1.9% (n=10) had red meat, and 4.6% (n=22) consumed eggs. Dhal (32.2%, n=155) was the main pulse among the participants who consumed pulses 38.6% (n=189) for their dinner. Green leafy vegetables were consumed only by 11.8% (n=57) while fruits were consumed by 12.2% (n=59) of the participants for the dinner.

The results of the correlation analysis of the body measurements and time gap between breakfast and waking up time and the time gap between bedtime and dinner are presented in Table 2. There was no statistically significant correlation between body measurements and the time gap from waking up to breakfast and dinner to bedtime in this sample.

Table 2. Correlation between body measurements and time gap from breakfast to wake-up and dinner to bedtime.

Variable	n	r	p
BMI-time gap from waking up to breakfast	470	0.077	0.094
WC-time gap from waking up to breakfast	470	0.045	0.329
BMI-time gap from dinner to bedtime	429	0.097	0.054
WC- time gap from dinner to bedtime	429	0.065	0.178

BMI = Body mass index, WC = Waist circumference n=Sample size, r= Correlation, p=Significance level

DISCUSSION

Population-specific food consumption patterns provide valuable insights into the health-related risks prevailing in the country. This is the first cross-sectional study to our knowledge, identifying dietary patterns including food composition and meal timing of Sri Lankans.

Nearly three-quarters of the population did not consume any vegetables for breakfast, while nearly half of them did not have any vegetables for lunch and dinner. This indicates the undesirable circumstance in terms of vegetable consumption in the population as a whole. Nearly three-quarters of the participants did not consume any meat or meat equivalent for their breakfast, also nearly two-fifth of them did not consume it for lunch and dinner. Additionally, dried fish and sprats were the first most common meat or meat equivalent source while fish was the second most common option during all three main meals. Nevertheless, eggs, chicken, and red meat consumption was very low among this group. Similarly, a previous study which was done in one particular rural area of Sri Lanka also demonstrated that fresh fish and dried fish were the most consumed meat or equivalent option (Siriwardhana et al., 2014). Further, eggs, chicken, and red meat consumption were less common according to them (Siriwardhana et al., 2014) which is consistent with our results. However, Western diets were characterized by the high intake of animal products including red and processed meat (Pan et al., 2012). It was identified that consuming at least small amounts of meat or equivalents such as

chicken, eggs and red meat could be an essential source of protein and micronutrients particularly in lower-income countries where diets lack diversity (Kearney, 2010). Therefore, our attention should be focused on enhancing meat or equivalent consumption in every meal. Pulses were not consumed by more than half of the study participants for all three major meals, and also dhal was the most common pulse type in their meals. Consumption of green leafy vegetables was also not favorable among this study group because only one-tenth of the population consumed it in each meal. According to a study carried out in South Korea, intake of vegetables and pulses was found to be more significant in the groups with a higher level of knowledge on nutrition (Jo et al., 2013). Therefore, it is acknowledged that improving awareness on nutrition through education or consultation is required to increase their consumption of the aforementioned food groups, consequently promoting diet diversity (Jayawardena, Byrne, Soares, Katulanda, Yadav, et al., 2013).

One-third of the population had mid-morning and evening snacks. This indicates that having snacks between main meals was not common among this group. Having snacks all day long is likely to affect hunger at subsequent meals (Gayle Savige, Abbie MacFarlane, Kylie Ball and Crawford, 2007). Hence, this group might be most likely to reduce their snacks either as a conscious decision or as a result of increased satiety because almost all the participants consumed breakfast and lunch which may diminish their sense of hunger through in-between meals. In the present survey, biscuits, confectionaries, pastries, and other starchy foods were the most common types of snacks, whereas fruits were consumed by a small number of participants for mid-morning and evening snacks. Fruit consumption, on the other hand, was not complimentary during main meals. Reasons behind selecting those types of foods instead of fruits for snacks may be due to the low cost, convenience, flavorful and satisfying nature of the those snacks due to high sodium (salt) content. However, as those foods are prepared with low-cost ingredients such as refined grains, sugar, and fats instead of nutritious ingredients such as whole grains, fruits, vegetables, and dairy, it is harmful to consume those foods regularly, because eating them too much over a long period can lead to health issues such as high blood pressure, heart diseases, and unwanted weight gain. Recent systematic reviews and meta-analyses also have shown that low fruit and vegetable intake are common among South Asians (Jayawardena et al., 2020). The low intake of fruits was recorded as the third leading dietary risk factor for nearly 2 million deaths and 65 million disability-adjusted life-years globally (Afshin et al., 2019). Therefore more attention needs to be paid to realistic modifications of dietary choices in preventing NCDs.

No individual was taking dairy products during their main meals. Only two participants consumed it for their mid-morning snack but none of them consumed any dairy product for their evening snack. According to the previous findings, the main reason for the lower consumption of dairy food is the high cost of dairy products (Kubicová, Predanocyová and Kádeková, 2019). The dairy food requirement of this study group was fulfilled primarily through the most common drink at wake-up, full cream milk powder added tea which was prepared by mixing powdered milk with ‘tea’ which affects the absorption of calcium to the body from the milk (Gueguen and Pointillart, 2000). However, for the mid-morning and evening drink, almost all participants drank ‘plain tea’ (tea without milk). Evidence suggests that tea appears to be safe without significant side effects and protects against several forms of cancer, bacterial infections, and dental caries (Trevisanato, 2001). Although polyphenols in tea reduce the bioavailability of non-haem iron, tea only

inhibits this iron absorption when it is concurrently consumed with a meal containing non-haem iron (Trevisanato, 2001).

According to the present analysis, there was no significant association between BMI or waist circumference (WC) and the time gap between waking up and breakfast as well as the time gap between dinner and sleep. However, it has been previously found that eating later and closer to sleep onset has an impact on metabolic dysfunction since insulin response to evening meals is lower, and thus, glucose levels remain high over a longer period (Buxton et al., 2012). There was a considerable variability among participants in the timing of the first meal to waking up and the last meal to bedtime. For example, while the average time for breakfast was 8:17 a.m., breakfast might be taken as early as 5:30 a.m. or as late as 11:30 a.m. Furthermore, the average duration between morning drink and getting up was 3 h, although the range was 30 min to 7 h. In addition, the average last meal was at 8:18 p.m., although it ranged from 5:30 p.m. to 11:45 p.m. Although the timing of food intake was found to be related to obesity and the success of weight-loss therapy (Garaulet and Gomez-Abellán, 2014), the association between mealtime and body measurements was not meaningful in the current study due to the significant time variability.

There were several limitations in this study. Although a one-day 24-h dietary recall is appropriate to estimate population mean intakes in a cross-sectional study, future research should include multiple days and detailed information about the quantity of each food taken during each meal. However, due to logistic and infrastructural constraints, it was not possible to include more recalls. Future research needs to consider conducting a national food intake survey comprising the detailed composition of both qualitative and quantitative data over the day to enhance the understanding of Sri Lankan dietary practices.

CONCLUSIONS

The meals consumed by the majority of the study population is unhealthy and lack of variation across all food categories including fruits, vegetables, green leafy vegetables, dairy, meat or equivalents, and pulses. In each of the three major meals, a significant proportion of the research group preferred rice with dhal curry. Biscuits, confectionaries, pastries, and other starchy foods were the most common types of snacks, whereas fruits were consumed by a small number of participants as snacks. Fruit consumption, on the other hand, was not complimentary during main meals too. Although almost all the participants consumed the three main meals, there was a significant variation in meal timings.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

SUPPLEMENTARY MATERIAL

For supplementary material referred to in this article, please visit the journal website: https://nutritionsocietyofsrilanka.org/the-journal-of-nutrition-and-food-sciences-2/

REFERENCES

Afshin, A., Sur, P. J., Fay, K. A., Cornaby, L., Ferrara, G., Salama, J.S., *et al.* (2019) 'Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017', *The Lancet*, 393(10184), pp. 1958–1972. doi: 10.1016/S0140-6736(19)30041-8.

Buxton, O. M., Cain, S.W., O'Connor, S. P., Porter, J.H., Duffy, J.F., Wang, W., Czeisler, C.A., & Shea, S. A. (2012). Adverse metabolic consequences in humans of prolonged sleep restriction combined with circadian disruption. *Science translational medicine*,

4(129), 129ra43. https://doi.org/10.1126/scitranslmed.3003200

Cespedes, E. M., & Hu, F. B. (2015). Dietary patterns: from nutritional epidemiologic analysis to national guidelines. *The American journal of clinical nutrition*, *101*(5), 899–900. https://doi.org/10.3945/ajcn.115.110213

De Silva, W. I., Engelgau M., Okamoto K., Navaratne K.V., Gopalan S. (2013) Prevention and control of selected chronic NCDs in Sri Lanka: Policy Options and Action Internet. doi: 10.4038/sljass.v2i1.5117.

Garaulet, M., & Gómez-Abellán, P. (2014). Timing of food intake and obesity: a novel association. *Physiology & behavior*, *134*, 44–50. https://doi.org/10.1016/j.physbeh.2014.01.001

Garaulet, M., & Madrid, J. A. (2010). Chronobiological aspects of nutrition, metabolic syndrome and obesity. *Advanced drug delivery reviews*, *62*(9-10), 967–978. https://doi.org/10.1016/j.addr.2010.05.005

Savige, G., Macfarlane, A., Ball, K., Worsley, A., & Crawford, D. (2007). Snacking behaviours of adolescents and their association with skipping meals. *The international journal of behavioral nutrition and physical activity*, *4*, 36. https://doi.org/10.1186/1479-5868-4-36

Guéguen, L., & Pointillart, A. (2000). The bioavailability of dietary calcium. *Journal of the American College of Nutrition*, *19*(2 Suppl), 119S–136S. https://doi.org/10.1080/07315724.2000.10718083

Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., & Hills, A. P. (2013). Food consumption of Sri Lankan adults: an appraisal of serving characteristics. *Public health nutrition*, *16*(4), 653–658. https://doi.org/10.1017/S1368980012003011

Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., Yadav, B., & Hills, A. P. (2013). High dietary diversity is associated with obesity in Sri Lankan adults: an evaluation of three dietary scores. *BMC public health*, *13*, 314. https://doi.org/10.1186/1471-2458-13-314

Jayawardena, R., Jeyakumar, D. T., Gamage, M., Sooriyaarachchi, P., & Hills, A. P. (2020). Fruit and vegetable consumption among South Asians: A systematic review and meta-analysis. *Diabetes & metabolic syndrome*, *14*(6), 1791–1800. https://doi.org/10.1016/j.dsx.2020.09.004

Jo, J. E., Park, H. R., Jeon, S.B., Kim, J.S., Park, G.E., Li, Y., Lim, & Y.S., Hwang, J.,(2013) A study on relationship between socio-demographic factors and food consumption frequencies among adolescents in South Korea: using the Korea youth risk behavior web-based survey from 2011', *Korean Journal of Community Nutrition*, 18(2), p.165. https://doi.org/10.5720/kjcn.2013.18.2.165

Katulanda, P., Constantine, G. R., Mahesh, J. G., Sheriff, R., Seneviratne, R. D., Wijeratne, S., Wijesuriya, M., McCarthy, M. I., Adler, A. I., & Matthews, D. R. (2008). Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka-Sri Lanka Diabetes, Cardiovascular

Study (SLDCS). *Diabetic medicine: a journal of the British Diabetic Association*, *25*(9), 1062–1069. https://doi.org/10.1111/j.1464-5491.2008.02523.x

Kearney J. (2010). Food consumption trends and drivers. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *365*(1554), 2793–2807. https://doi.org/10.1098/rstb.2010.0149

Kubicova, L., Predanocyova, K. & Kadekova, Z. (2019). The importance of milk and dairy products consumption as a part of rational nutrition. *Potravinarstvo Slovak Journal of Food Sciences*, 13(1), pp. 234–243. https://doi.org/10.5219/1050

Pan, A., Sun, Q., Bernstein, A. M., Schulze, M. B., Manson, J. E., Stampfer, M. J., Willett, W. C., & Hu, F. B. (2012). Red meat consumption and mortality: results from 2 prospective cohort studies. *Archives of internal medicine*, *172*(7), 555–563. https://doi.org/10.1001/archinternmed.2011.2287

Ruxton, C. H., & Kirk, T. R. (1997). Breakfast: a review of associations with measures of dietary intake, physiology and biochemistry. *The British journal of nutrition*, *78*(2), 199–213. https://doi.org/10.1079/bjn19970140

Siriwardhana, E. A., Perera, P. A., Sivakanesan, R., Abeysekara, T., Nugegoda, D. B., & Weerakoon, K. G. (2014). Is the staple diet eaten in Medawachchiya, Sri Lanka, a predisposing factor in the development of chronic kidney disease of unknown etiology? - A comparison based on urinary β2-microglobulin measurements. *BMC nephrology*, *15*, 103. https://doi.org/10.1186/1471-2369-15-103

Swarnamali, A. K. S. H., Jayasinghe, M. V. T. N. & Katulanda, P. (2015). Identification of risk factors for selected non communicable diseases among public sector office employees, Sri Lanka. *LIFE: International Journal of Health and Life-Sciences*, 1(2), pp. 12–24. doi:10.20319/lijhls.2015.12.1224.

The World Bank (2007) *Sri Lanka Malnutrition in Sri Lanka Scale, Scope, Causes, and Potential Response*. Available at:http://documents1.worldbank.org/curated/pt/362351468294030335/pdf/409060SR0P09961disclosed0Feb0602008.pdf (Accessed: 11 July 2020).

Trevisanato, S. I., & Kim, Y. I. (2000). Tea and health. *Nutrition reviews*, *58*(1), 1–10. https://doi.org/10.1111/j.1753-4887.2000.tb01818.x

USDA (2015) *2015-2020 Dietary Guidelines for Americans*. Available at: http://health.gov/dietaryguidelines/2015/guidelines/. (Accessed: 13 October 2020).

Wang, J. B., Patterson, R. E., Ang, A., Emond, J. A., Shetty, N., & Arab, L. (2014). Timing of energy intake during the day is associated with therisk of obesity in adults. *Journal of human nutrition and dietetics: the official journal of the British Dietetic Association*, *27 Suppl 2*, 255–262. https://doi.org/10.1111/jhn.12141

WHO Expert Consultation (2004).

Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet (London, England)*, *363*(9403), 157–163. https://doi.org/10.1016/S0140-6736(03)15268-3

WHO (2017) *Guide to Physical Measurements (Step 2) Overview*. WHO (2018) *Noncommunicable diseases*.http://www.who.int/newsroom/factsheets/detail/noncommunicable-diseases.

World Health Organization (2009) *Mortality and burden of disease attributable to selected major risks*. https://apps.who.int/iris/handle/10665/44203

World Health Organization Regional Office for Europe (2014) *Prevention and control of noncommunicable diseases in the European Region: a progress report*. https://www.euro.who.int/__data/assets/pdf_file/0004/235975/Prevention-and-control-of