

## PRELIMINARY FINDINGS OF MALNUTRITION RISK FACTORS AMONG OLDER ADULTS IN A CARE HOME

Siti Al-Baidakh, A.A.<sup>1</sup>, Barakatun-Nisak, M.Y.<sup>1</sup>, and Noraida, O.<sup>1,2</sup>

<sup>1</sup>Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

<sup>2</sup>Malaysian Research Institute on Ageing (MyAgeing), Universiti Putra Malaysia, Selangor, Malaysia.

*\*Corresponding author: Dr. Noraida Omar, Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor. Email: noraidaomar@upm.edu.my*

<https://doi.org/10.32827/ijphcs.6.1.209>

### ABSTRACT

**Background:** Older adults are at risk of nutrient deficiencies. They face many barriers to have an adequate intake that leads to malnutrition. Among Malaysian institutionalized elderly aged 60 years and above, the prevalence of malnutrition was 17.4% and it was associated with eating half of the food served in the institution.

**Materials and Methods:** This cross-sectional study aimed to determine the association between adequacy of nutrition provision and plate wastage with risk of malnutrition among elderly aged  $\geq 60$  years in Rumah Seri Kenangan, Cheras (RSK) (N=46). The study used Mini Nutritional Assessment (MNA) to assess malnutrition risk, weighing method for adequacy and plate waste study. Mean of energy and protein (served, consumed and wasted) were compared with the Malaysian Recommended Nutrient Intake (RNI).

**Results:** Majority of the subjects were male (65%; n=30) and 35% were females (n=16). Mean age of the subjects was  $71.35 \pm 7.21$  years. Majority of the subjects were classified as well-nourished (50%) and 13% as malnourished. Total energy served in one-lunch time was inadequate ( $82.67 \pm 12.93\%$  of RNI) but total protein served was adequate ( $108.59 \pm 19.63\%$  of RNI). Total energy and protein consumption were inadequate with the mean percentage of RNI for energy and protein was  $47.09 \pm 26.39\%$  and  $73.50 \pm 32.07\%$  respectively. Surprisingly, energy and protein served, consumed and wasted were not associated with risk of malnutrition.

**Conclusion:** Energy provision and intake and protein intake did not meet the RNI for Malaysians among older adults in RSK Cheras, Selangor. However, the adequacy of nutrition provision and plate wastage during the one-lunch time were not associated with the risk of malnutrition..

**Keywords:** Malnutrition, older adults, plate wastage.

## 1.0 Introduction

Most developed countries have adopted the chronological age of 65 years old as the elderly or older people [4]. However, according to Department of Social Welfare Malaysia [5], elderly are those aged 60 years and above. Moreover, another study [6] claimed that there is no specific provision of law that define elderly in Malaysia.

According to Dietetic Institute in Ireland [7], malnutrition is a state of nutrient deficiency that produces measurable changes in body functions and is made worse as a result of illnesses. However, one Malaysian study [8] defined malnutrition as faulty or inadequate nutritional status characterized by insufficient dietary intake, poor appetite, and muscle wasting and weight loss. However, earlier studies [9], [10] & [11] defined malnutrition as a low energy and protein intake between 50% and 75% of the recommendation or minimal requirement.

According to National Institute of Health and Clinical Excellence [12], the prevalence of malnutrition among elderly in long care units or nursing homes was 10-70% in which, it was quite high compared to non-institutionalised elderly (>10%) and hospitalised elderly for acute illness which is 10-50%. Another study involving data from 12 countries and at different settings reported that the prevalence of malnutrition among older adults was approximately 23% [13]. Previous Malaysian studies demonstrated that 14-17% elderly in residential institutions were malnourished [14],[15].

Adequacy of nutrition provision is defined as the comparison between the nutrient requirement and the nutrients that is provided for certain population or individuals [16]. The plate wastage refers to the volume or percentage of the served food that is discarded [17]. One study claimed that most of the older adult were at risk of developing malnutrition due to lack of adequate nutrition to maintain health [18]. Another study stated that malnutrition was associated with eating half or less of food that was provided at mealtimes [19].

## 2.0 Materials and Methods

### 2.1 Sampling

There are nine Rumah Seri Kenangan (RSK) (elderly care home) in Malaysia and RSK Cheras was chosen. It is located in Kajang, Selangor. Out of 119 permanent residents (60 years and above, self-feeding and of at least 1 month length of stay), 46 residents gave consent to participate in this study.

### 2.2 Data collection

The subjects were interviewed to obtain information about their socio-demographic background and to assess the risk of malnutrition using full Mini Nutritional Assessment (MNA). From a previous study, MNA was known as both screening and assessment tools for

the identification of malnutrition among older adults [20]. The full-MNA consists of 18 items and evaluates dietary, anthropometric, global and self-viewed aspects of nutrition [21]. Subjects with a total score  $<17$  on the full MNA, were considered being malnourished; a score between 17 and 23.5 being at risk of malnutrition while a score 24 and above being well-nourished [22].

Anthropometric measurements such as weight were measured using portable digital weighing scale (TANITA Weighing) in light clothing (without shoes). Height (SECA 206 bodymeter) was measured while the subjects standing to the nearest 0.5cm. Then, Body Mass Index (BMI) was calculated [weight in kg/(height in m<sup>2</sup>)]. The Mid Upper Arm Circumference (MUAC) and Calf Circumference (CC) were also measured by using SECA measuring tape.

Food served during one-lunch time and their plate wastage were measured using a digital food weighing scale to the nearest 0.1kg. The nutrient composition of food served and consumed by the subjects was analyzed using Nutritionist Pro Software. Then, the percentage of energy and protein (served, consumed and wastage) were compared to 30 % of Recommended Nutrient Intake (RNI) for Malaysian (2005) as meals served during one-lunch time should contribute about 30% of daily requirements [23].

### 2.3 Statistical analysis

The Statistical Package for Social Sciences (SPSS) program version 21 was used to analyse the data. Univariate analysis (percentage and mean  $\pm$  SD) was used to assess the socio-demographic background, anthropometric parameters, risk of malnutrition, adequacy of nutrition provision and plate wastage. Independent sample t-test was used to determine differences for continuous variables between genders. The association between Total MNA Score with socio-demographic, anthropometric parameters, adequacy of nutrition provision and plate wastage were explored using Chi-squared test and Pearson Correlation test with the level of significance  $p < 0.05$ .

## 3.0 Results

### 3.1 Sociodemographic and Health Profiles

The total subjects involved in this study were 46 elderly people where 65% of them were male and 35% of them were female. As shown in table 1, the mean age of the subjects was  $71.35 \pm 7.21$  years. By comparing between both genders, the mean age for female was slightly higher than male.

However, Independent-samples t-test found that, there was no significant difference in age for males,  $71.23 \pm 7.32$  years and female,  $71.56 \pm 7.23$  years ( $t = -0.146$ ,  $p = 0.89$ ). The difference in age between genders in care home might due to the difference in life expectancy where one study conducted among Singaporean [24] found that, women have higher life expectancy than men at birth and at 65 years. Moreover, according to Department of Statistic, Malaysia [25],

the life expectancy of female (77.2 years) was higher than male (72.5 years). The finding was consistent with the National Statistic [26] among residents in Care Home, England where most of the elderly women in the care homes were older than men in which more elderly women (64.7%) than men (43.7%) in age group of 85 and over while more elderly men classified in younger age group (65-84 years old).

Most of the subjects were single which was 45.7% of total subjects and the least were widowed which was 6.5%. Most of the male subjects were single with 56.7% of the total male subjects while most of the female subjects were married which was 56.2% of the total female subjects. However, there was no significant association in marital status ( $\chi^2=5.51$ ,  $p=0.136$ ) between genders.

In term of ethnicity, majority of the subjects were Malay which contributed about 65% of the total subjects followed by Indian (19.6%), Chinese (15.2%) and there was only one (2.2%) subject who was Punjabi. In both genders, Malay was a dominant ethnicity where 66.7% of male subjects and 56.2% of female were Malay. However, Chi-square test found that, there was no significant association in ethnicity ( $\chi^2=1.28$ ,  $p=0.733$ ) between genders.

Half of the male and female subjects claimed that, their highest education level was primary school that make 50% of the overall subjects had primary school education and only 2 (4.3%) of them finished their education level until diploma level. Chi-square test showed that, there was no significant association in educational level between genders ( $\chi^2=4.49$ ,  $p=0.214$ ).

The total mean length of stays of the subjects participated in this study was  $32.78 \pm 17.40$  months. The male subjects stayed longer than female subjects, but Independent-samples t-test found that, there was no significant difference in length of stay (month) between genders ( $t=1.84$ ,  $p=0.073$ ), where male subjects,  $36.13 \pm 17.3$  months and female subjects,  $26.5 \pm 16.27$  months.

In term of health problem, half of the male subjects (50%) had diabetes and more than half (68.8%) of the female subjects had hypertension and diabetes. However, Chi-square test showed, there was only diabetes mellitus that had a significant association between genders ( $\chi^2=8.65$ ,  $p=0.003$ ), and there was higher proportion of female subjects (68.8%) having diabetes mellitus compare to male subjects (20%). Another study among elderly at old folks home at Penang found that the prevalence of hypertension was 62.6% while diabetes mellitus was 25.8% [27]. This showed that, the finding from the previous study was consistent with this study which found that, majority of the subjects had hypertension then followed by diabetes mellitus.

### 3.2 Anthropometric Measurements

As depicted in figure 2, 15.2% of the subjects were classified as chronic energy deficiency ( $16.00-18.49 \text{ kg/m}^2$ ) and most of them were males. However, Chi-square test showed that, there was no significant association in BMI classification ( $\chi^2=2.957$ ,  $p=0.398$ ) between genders. The finding was quite similar to the previous study [28] whereby, the majority of the

elderly residents in care home Selangor were classified as overweight rather than chronic energy deficiency [24].

Moreover, another cross sectional study among institutionalized elderly in Malaysia had found that, majority of the residents had normal Body Mass Index, BMI (24.9-25.0 kg/m<sup>2</sup>) [2]. However, it was reported that, elderly women had significantly higher proportion of overweight (35.6%) and underweight (20.7%) compared with elderly males [2].

**Table 1: Sociodemographic background of the subjects in RSK, Cheras (N=46)**

Characteristics	Male (n=30)	Female (n=16)	Total (n=46)	t-value	p-value
<b>Mean ± SD</b>					
Age	71.23±7.32	71.56±7.23	71.35±7.21	-0.146	0.885
Length of Stay (month)	36.13±17.3	26.5±16.27	32.78±17.40	1.84	0.073
Characteristics	n(%)	n(%)	n(%)	χ <sup>2</sup>	p
Ethnicity				1.28	0.733
Malay	20(66.7)	9 (56.2)	29(63.0)		
Chinese	4 (13.3)	3 (18.8)	7(15.2)		
Indian	5 (16.7)	4 (25.0)	9(19.6)		
Other	1 (3.3)	0 (0.0)	1(2.2)		
Marital Status				5.51	0.136
Single	17 (56.7)	4(25.0)	21(45.7)		
Married	7(23.3)	9(56.2)	16(34.8)		
Divorced	4(13.3)	2(12.5)	6(13.0)		
Widowed	2(6.7)	1(6.2)	3(6.5)		
Education Level				4.49	0.214
None	3(10.0)	2(12.5)	5(10.9)		
Primary School	15(50.0)	8(50)	23(50.0)		
Secondary School	12(40.0)	4(25)	16(34.8)		
Diploma	0(0.0)	2(4.3)	2(4.3)		
Previous Occupation				8.96	0.062
None	1(3.3)	0(0.0)	1(2.2)		
Housewife	0(0.0)	4(25.0)	4(8.7)		
Government	7(23.3)	4(25.0)	11(23.9)		
Owned bussiness	10(3.3)	4(25.0)	14(30.4)		
Self Employed	12(40.0)	4(25.0)	16(34.8)		
Total Monthly Income (for previous occupation)				6.40	0.171
None	1(3.3)	4(25.0)	5(10.9)		
RM100 or below	13(43.3)	5(31.2)	18(39.1)		
<RM1000	11(36.7)	3(18.8)	14(30.4)		
RM1000-RM5000	4(13.3)	3(18.8)	7(15.2)		
>RM5000	1(3.3)	1(6.2)	2(4.3)		

Based on MUAC measurements, there were 10.9% of male subjects had loss of peripheral muscle mass, but there was no female subjects that classified as loss of peripheral muscle mass. However, the Chi-square test found that, there was no significant association in the classification of MUAC ( $\chi^2=1.52$ ,  $p=0.218$ ) between genders. Another anthropometric parameter of muscle loss which was CC also found that, there were more males (15.2%) that classified as loss of lower limb muscle.

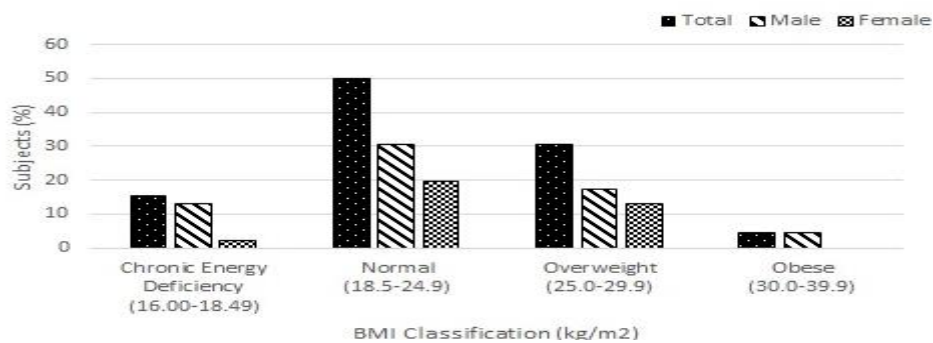


Figure 2: Body mass index classification of the older adults in RSK Cheras

### 3.3 Nutritional Status

Based on the figure 3 shown below, the prevalence of malnutrition in RSK Cheras was 13% and 37% of the subjects classified as at risk of malnutrition. Half of the male subjects (50%) had diabetes and more than half (68.8%) of the female subjects had hypertension and diabetes. However, Chi-square test showed, there was only diabetes mellitus that had a significant association between genders ( $\chi^2=8.65$ ,  $p= 0.003$ ), and there was higher proportion of female subjects (68.8%) having diabetes mellitus compare to male subjects (20%).

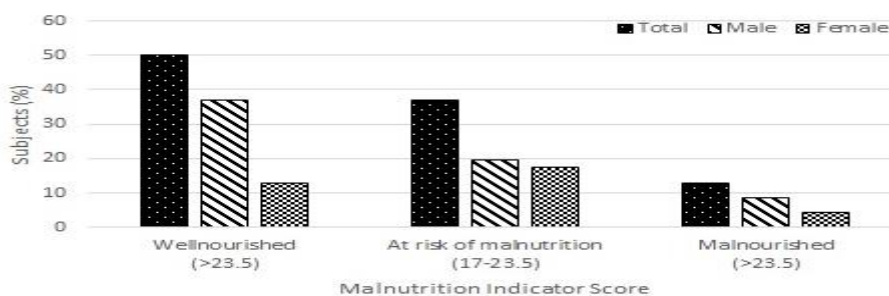


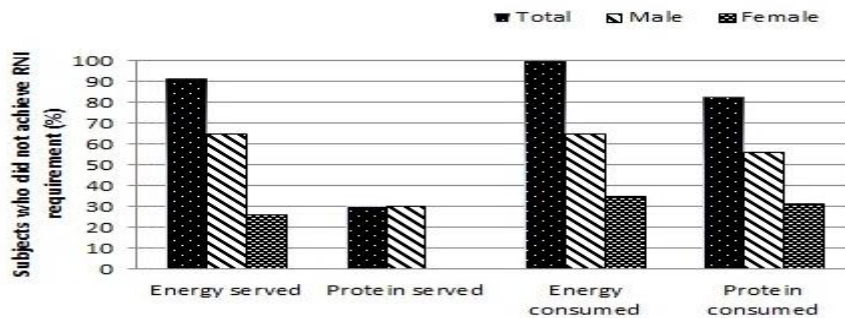
Figure 3: Risk of malnutrition of older adults in RSK Cheras

### 3.4 Audit of Food Provision and Plate Wastage at One-Lunch Time.

#### 3.4.1 Food served

The figure 4 showed that, 91.3% of the total subjects were not received adequate energy and of them were males. In term of protein served, all female subjects received adequate protein but 30.4% of the total subjects which were male subjects not received protein adequately. As shown in figure 5, protein served was met the RNI but not the energy served. However, the

mean percentage of protein served for females (117%) was higher than males (104.4%) and the differences were significant ( $p=0.044$ ). In line with the previous study, it was stated that, the menu served in the care home was not consistently served adequately according to the recommendation of nutrients [29]. In contrast with the studies conducted in Singapore and Europe where they found that, the energy and protein served in the elderly care home were met the requirement[2],[30].



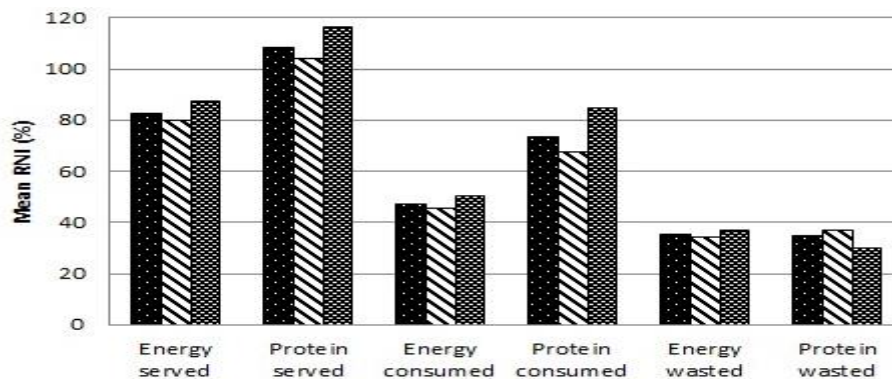
**Figure 4: Proportion of subjects who not achieved RNI for Energy and Protein (Served & Consumed) for one-lunch time**

### 3.4.2 Food Consumed

The figure 4 also showed that, the food consumed by all the subjects (100%) were not met RNI for energy and protein. This might due to the energy served which was also not met the RNI. By comparing between genders as in figure 5, there was higher mean percentage of RNI for energy (50.3%) and protein (84.9%) consumed by female subjects, but the differences were not significant, where  $p=0.549$  and  $p=0.079$  respectively. Similar to previous studies conducted in Malaysia, Australia and some European country which stated that, the energy and protein consumption by the institutionalised elderly did not met their requirement and the differences between genders was not significant [31],[32],[33]& [34].

### 3.4.3 Food Wastage

Based on the figure 5 shown below, the mean percentage of RNI for energy wasted by female subjects (36.8%) were slightly higher than males (34.6%) and it was opposite for protein whereby, protein wasted by males was higher than female subjects. However, it was not statistically significant, where  $p=0.764$  and  $p=0.432$  respectively. This finding was consistent with the previous studies in Singapore and Spain that were conducted among elderly in care home [2], [34].



**Figure 5: Mean percentage of RNI for energy and protein served, consumed and wasted according to genders**

### 3.5 Risk of Malnutrition

Overall, there was no significant correlation between socio-demographic background with the risk of malnutrition except the length of stays ( $p=0.026$ ,  $r=-0.33$ ). There were also significant correlation between weight ( $p=0.003$ ,  $r=0.43$ ), BMI ( $p=0.001$ ,  $r=0.48$ ), MUAC ( $p=0.002$ ,  $r=0.44$ ) and CC ( $p=0.001$ ,  $r=0.51$ ) with the risk of malnutrition.

However, there was no significant correlation between energy served ( $p=0.395$ ,  $r=-0.13$ ), protein served ( $p=0.378$ ,  $r=-0.13$ ), energy wasted ( $p=0.730$ ,  $r=0.05$ ) and protein wasted ( $p=0.04$ ,  $r=0.815$ ) with the risk of malnutrition.

## 4.0 Discussion

This study showed that, half of the total subjects were classified as normal BMI based on the classification developed by WHO (1997), followed by overweight and only minority of them were classified as chronic energy deficiency. The BMI for female subjects were slightly higher than males but the difference was not significant. The finding was quite similar to the previous study by Suzana & Siti Saifa (2007) whereby, the majority of the elderly residents in care home Selangor were classified as overweight rather than chronic energy deficiency. Moreover, another cross sectional study among institutionalized elderly in Malaysia had found that, majority of the residents had normal Body Mass Index, BMI (24.9-25.0 kg/m<sup>2</sup>). However, it was reported that, elderly women had significantly higher proportion of overweight (35.6%) and underweight (20.7%) compared with elderly males (Chen et al., 2012).

Majority of the subjects that were classified as normal nutritional status were males as most of the female subjects were classified as at risk of malnutrition. In contrast with previous study that also used Mini Nutritional Assessment (MNA) form, it was found that the prevalence of malnutrition was higher among institutionalized elderly women and older age groups (Vandewoude & Van Gossum, 2013).

Overall, the mean percentage of RNI for energy served during one lunch time was inadequate as it was not met 100% while the mean percentage of RNI for protein served during one lunch time was adequate as it met or exceed 100% (Allington et al., 1980; Lengyel, 2002) of the 30% of RNI value which allocated for lunch meals (FSA, 2007). The female subjects had higher mean percentage of RNI for energy and protein served compared to male. The difference between genders in mean percentage of RNI for energy served during one lunch time was not significant but there was a significant difference in mean percentage of RNI for protein served during one lunch time. Compared to previous study by Beck & Hansen (2010) in nursing home at California, US with total subjects of 389, it was found that, the menu served was not consistently served adequately according to the recommendation of nutrients. However, a European study in Croatia by Baric et al. (2006) found that, the meals provided in the nursing home for elderly were adequate in energy and macronutrients. b) Food Consumption The energy and protein consumed were not adequate as the mean percentage of RNI for both energy and protein were not achieved 100% (Allington et al., 1980; Lengyel, 2002) of the 30% of RNI value which allocated for lunch meals (FSA, 2007). It was also noted that, the mean percentage of RNI for energy consumed was lower compared to protein. Between genders, it was similar as in food served whereby the mean percentage of RNI for energy and protein consumed were also 62 higher among female. However, the difference in mean percentages of RNI for energy and protein consumed during one lunch time for males and female and were not significant. Besides, both females and males consumption was still considered as not achieved the requirement. In contrast with previous study by Greacen et al. (2014) which found that, the total means consumption of energy and protein among the elderly subjects were low. However, the finding was consistent with the present study whereby protein consumption among female subjects (45%) was more adequate than male subjects (29%) when compared to Estimated Average Requirement (EAR). In term of gender, the finding of the present study was consistent with previous study which found that, the differences in average of protein consumed between elderly male and female subjects was not significant (Milà Villarroe et al., 2012).

### ***c) Food Wastage***

From this study, it was noted that, there was higher mean percentage of RNI for energy wastage among female subjects but for protein, there was higher mean percentage of RNI for protein wastage among male subjects. The difference in energy wastage between genders might due to the difference in the energy served mention earlier whereby there was higher energy served for female compared to male. Despite there was also higher in protein served for females, the protein wastage for females were lesser than males because there was higher consumption of protein among females compared to males subjects. The finding from the previous study by Milà Villarroe et al. (2012) also found that, the mean of energy wasted between male and female subjects was not significantly difference. In addition, the study claimed that, the highest percentage of 63 energy wasted was in the main meal which consequently leads to highest loss of energy. The author also claimed that, there was greater food wastage during lunch time (20%) than during dinner (15%).

### **5.6 Reasons of Plate Wastage**

Based on the face-to-face interview with the subjects, most of the subjects claimed that, they not finished the food served as they had loss of appetite. Loss of appetite was classified under clinical reason based on the categories of reason of plate wastage that adapted from the guideline on managing food waste provided by National Health Service, 2005. The second reason was due to the meal service at RSK, Cheras. It was claimed that, it was unacceptable and therefore they tend to not finish their foods. Majority of the total subjects who at risk of malnutrition had plate waste due to unacceptable meal service while among malnourished subjects, they had several reason that include loss of appetite, unacceptable meal service and food issues where each categories of reason had the same percentage that contribute to plate wastage. However, it was found that, the Malnutrition Indicator Score with the reported reason of plate wastage was not significant. This might due to the bedridden/ older adults which were not able to dine at the dining area were excluded in this study. This group of elderly might contribute to higher percentage of malnourished. The finding of the present study was quite similar with the study by Hanisah et al. (2012) which claimed that , the poor appetite was one of the main factors of poor nutritional status among elderly whether outpatient or inpatient. Another study in Singapore by Lai et al. (2012) stated that, the main reason of high plate wastage was the inadequate time for the elderly to finish their meals. 64 In addition, the texture of the food provided need to be revised as there were several claimed by the subjects that the food provided was too hard for them to chew and make them choking which results loss of appetite. In term of the time given for the residents to eat or finish their meal, some of the subjects claimed that, it was too short and they rushing to finish their meal but they were too old to eat quickly. Consequently, they just left their food even they still hungry.

### **5.0 Conclusion and recommendation**

The prevalence of malnutrition in RSK Cheras was 13 % and 37 % of the subjects were at risk of malnutrition. In term of nutrition provision and consumption, the energy (served and consumed) and protein consumed by the elderly subjects in RSK Cheras were not met the calculated RNI for one-lunch time. However, the adequacy of nutrition provision (energy and protein served) and the energy and protein wasted were not associated with the risk of malnutrition. There are several recommendations regarding the issue of adequacy of food provision whereby, it would be better for the food service in the care home to have standard tools to portion the meals and the dietitian is recommended to regularly monitor the food service management in the care home. Finally, it is good if the staffs are trained to manage food preparation for elderly.

## Acknowledgement

Special thanks to the residents in RSK Cheras that participate and the staff that help also to all volunteers who assisted with data collection.

## Declaration

Authors of this article declare that there was no conflict of interest regarding on publication and this article was originally based on the real study conducted by the authors.

## Authors' contribution

Author 1: Collected the data

Author 2: Co-investigator

Author 3: Principle investigator

## References

1. World Health Organization. Definition of an Older or Elderly Person. 2013.
2. Department of Social Welfare Malaysia. Senior Citizen Services. 2012
3. Lim X, Sulaiman N. A conceptual framework for understanding the social care facilities management audit at the residential care home for the elderly in Malaysia. Paper presented at the 2nd International Conference on Management, Economics and Finance, Sabah, Malaysia. 2013
4. Irish Nutrition and Dietetic Institute. Nutrition in Residential Care Setting. A Healthcare Professionals Guide. 2014.
5. Chen ST, Hooi NJ, Harith S. Prevalence of Malnutrition among Institutionalized Elderly People in Northern Peninsular Malaysia: Gender, Ethnicity and Age-Specific. *Sains Malaysiana*. 2012; 41(1), 141-148
6. Stevens DA, Grivetti LE, McDonald RB. Nutrient intake of urban and rural elderly receiving home-delivered meals. *Journal of American Dietetic Association*. 1992; 92, 714-720.
7. Posner BM, Jett AM, Smigelski CG, Miller D, Mitchell P. Nutritional risk in New England Elders. *Journal of Gerontology: Medical Science*. 1994; 49, 123-132.
8. Sullivan DH, Sun S, Walls RC. Protein-energy undernutrition among elderly hospitalized patients: a prospective study. *Journal of American Medical Association*. 1999; 281, 2013-2019.

9. National Institute for Health and Clinical Excellence. 2006.
10. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Frequency of malnutrition in older adults: a multinational perspective using the mini nutritional assessment. *Journal of American Geriatric Society*. 2010; 58 (9), 1734-1738.
11. Suzana S, Earland J, Suriah AR, Warnes AM. Social and health factors influencing poor nutritional status among rural elderly Malays. *Journal Nutrition Health Aging*. 2002; 6(6), 363–369.
12. Visvanathan R, Zaiton A, Sherina MS, Muhamad YA. The nutritional status of 1081 elderly people residing in publicly funded shelter homes in Peninsular Malaysia. *European Journal of Clinical Nutrition*. 2005; 59, 318-324.
13. Castro-Quezada I, Roman-Vinas B. The Mediterranean Diet and Nutritional Adequacy: A Review. *Multidisciplinary Digital Publishing Institute*. 2014; 6(1), 231-248.
14. William P, Walton K. Plate Waste in Hospitals and Strategies for Change. *Clinical Nutrition and Metabolism*. 2011; 6, 235-241.
15. Dahl WJ. Malnutrition and the older adult. *IFAS Extension Data Information Source*. 2013
16. Papparotto C, Bidoli E, Palese A. Risk Factors Associated With Malnutrition in Older Adults Living In Italian Nursing Homes: A Cross-Sectional Study. *Res Gerontology Nursing*. 2013; 6 (3), 187-197.
17. Amella EJ. Assessing nutrition in older adults. *Try This: Best Practices in Nursing Care to Older Adults*. 2007; 9.
18. Vella B, Guigoz Y, Philip J, Garry JP, Fati N, Bennahum D, Lauque S, Albarede JL.. The Mini Nutritional Assessment (MNA) and Its Use in Grading the Nutritional State of Elderly Patients. *Nutrition*. 1999; 15(2), 116-122.
19. Verbrugge M, Beeckman D, Van Hecke AV, Vanderwee K, Van Herck K, Clays E, et al. Malnutrition and Associated Factors in Nursing Home Residents: A Cross-Sectional, Multi-Centre Study. *Clinical Nutrition*. 2013; 32, 438-443.
20. Food Standards Agency. *Guidance on food served to older people in residential care*. 2007
21. Lai LF, Lee E, Ong D, Yeo D, Ban Y, Chiam YK, et al. An Observational Study on Meal Provision, Plate Wastage and Nutrient Intake in a Singapore Private Nursing Home. *Agency for Integrated Care*. 2012.
22. Department of Statistic, Malaysia. 2014.
23. National Statistic. 2014.

24. Teo C, Chung W, Khaw C, Rashid A. Hypertension and Diabetes Mellitus among The Residents Of An Old Folks Home in North Malaysia. *The Internet Journal of Geriatrics and Gerontology*. 2009; 6(1).
25. World Health Organization. Managing the global epidemic of obesity. Report of the World Health Organization (WHO) consultation on obesity. Paper presented at the International Obesity Task Force. Geneva .1997.
26. Suzana S, Siti Saifa, H. Validation of Nutritional Screening Tools against Anthropometric and Functional Assessments among Elderly People in Selangor. *Maaysian Journal of Nutrition* .2007; 13(1), 29-44.
27. Vandewoude M, Van Gossum A. Nutritional screening strategy in nonagenarians: the value of the MNA-SF (mini nutritional assessment short form) in Nutri Action. *Journal Nutrition Health Aging*. 2013; 17(4), 310-4.
28. Allington JK, Matthews ME, Johnson VK, Johnson NE. A short method to ensure nutritional adequacy of food served in nursing homes. II. Development of a model food plan. *Journal American Dietetics Association*. 1980; 76(5), 465-470.
29. Lengyel CO. Assessment of Food Service Delivery to Elderly Residents in Long term Care Facilities. (Unpublished doctoral dissertation).University of Saskatchewan, Saskatoon, Canada. 2002
30. Beck AM, Hansen KS. Meals served in Danish nursing homes and to Meals on wheels Clients May Not Offer Nutritionally Adequate Choices. *Journal Nutrition for the Elderly*. 2010; 29 (1), 100-109.
31. Baric IC, Satalic Z, Keser I. Impact of home-delivered meal programs on diet and nutrition among older adults: A review. *Nutrition and Health*. 2006; 18 (2),119-125.
32. Greacen M. Nutritional assessment of older New Zealand adults in Auckland residential care homes (Thesis, Master of Dietetics). University of Otago. 2015.
33. Milà VR, Abellana SR, Padró ML, Farran CA. Assessment of food consumption, energy and protein intake in the meals offered in four Spanish nursing homes. *Nutrición Hospitalaria*. 2012; 27 (3),914-921.
34. Hospitality. Managing food waste in the NHS. NHS Estates. 2005.