

Determination of Patient Perception on Hospital Diet and Quantitative Analysis of Salt, Crude Fat and Crude Protein Contents of Hospital Diets in Three Major Hospitals, Colombo, Sri Lanka- A Preliminary Study

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Abstract— Identifying deficiencies in hospital diet service and finding consumer needs regarding meals provided to them is a timely need in the health care sector. There are no published data on nutrient analysis of hospital diet coupled with patient perception in Sri Lanka. This study was carried out to determine the perception of patients on hospital diet and to analyze some basic contents of diets in three major hospitals in Colombo district, Sri Lanka. These hospitals cater three categories of patients; Adults, Pregnant Women (PW), and Children. The meal analysis was done following AOAC standard methods (Protein by the Kjeldahl method, fat by the Soxhlet method, salt by the Volhard method). The percentages of hospital diet consumption were, adults 43%, PW 21%, children 38%. The overall satisfaction of a majority who consumed hospital diet was good in all three hospitals. The excess percentages of salt content in the hospital diet than the Recommended Daily Allowance (RDA) were, adults 21.2%, PW 70.6%, children 31.6%. Protein contents in the adult, children and maternity hospitals were 23.79 ± 2.89 , 32.17 ± 2.89 and 57.14 ± 6.66 grams/day respectively. Only children and maternity hospital diets fulfill the RDA of proteins. Percentage calories from fat in the adult and the children hospitals were $14.45\% \pm 1.21$ and $18.80\% \pm 1.13$. Only in the maternity hospital the percentage of calories from fat 21.14 ± 0.79 was within the range of RDA. Continuous monitoring of hospital diet and regular communication with patients is recommended to improve the hospital diet service regarding patient satisfaction and food quality.

Keywords—Hospital diet, fat, protein, salt, patient perception

I. INTRODUCTION

Health care service is one of the major sectors that a country should pay attention on. Patient satisfaction is identified as a key criterion, which can be used to evaluate the health care service of a country [1]. Many developed countries have continuous assessments of the health care sector basically in relation to the food service. Sri Lanka yet being a developing country is very poor in this field and hospital diet analysis has not been done so far. Overcoming malnutrition especially protein malnutrition is a prominent necessity in insuring the development of the healthcare sector [2]. Hospital malnutrition is a timely area that should be concerned as it effects the strictness of the illness, lengthens the period of recovery and the time of hospital stay which directly effects the quality of life. Although hospital diet is provided at no cost to in ward patients, the consumption of hospital diet by patients is relatively low in most of the government hospitals in Sri Lanka. Hence it is of utmost importance to determine the qualitative analysis of hospital diet which plays a

prominent role in the determination of patient satisfaction in overall during their hospital stay.

Ministry of Health (MOH), Sri Lanka is now more attentive towards the increasing risk of Non Communicable Diseases (NCDs). It has been found that excess intake of salt and fat as some of the major causes for this issue [3]. Therefore food assessment in relation to these components has been given a prominent place by MOH, Sri Lanka. According to World Health Organization (WHO), over three quarters of global deaths occur due to NCDs in low and middle income countries including Sri Lanka. As recommended by the WHO, a healthy diet is more important to prevent these NCDs.

Salt has been considered significant in the research field related to the elevation of blood pressure (BP) and Cardio Vascular Diseases (CVDs). It has been identified that moderate reduction of dietary salt as an effective strategy to reduce BP. It is stated that consuming dietary salt in recommended levels of less than 5g/day is beneficial to

maintain a healthy cardiovascular health. Reducing the intake of dietary salt has been identified as a precaution to minimize the number of deaths from hypertension, CVDs and strokes [4, 5].

Protein is one of the major nutrient components that should be taken into the body in recommended levels through diets. Musculoskeletal health depends on dietary proteins. Structural proteins which are derived from dietary proteins are the basis of the human body structure. Dietary proteins are directly related to the body weight, growth and energy balance of the human body [6]. Protein energy malnutrition is a common problem worldwide and occurs in both underdeveloped and developed countries. Many in ward patients suffer from protein energy malnutrition (PEM) and weight loss [7, 8]. In the developing world, many factors including socioeconomic, environmental and political factors effect these health issues. There is an increasing risk of child deaths due to PEM and the attention towards finding solutions to this health issue is now of great concern [9]. Mainly there are different measures to define protein intake such as absolute intake (g day^{-1}), intake associated with body weight ($\text{g kg}^{-1}\text{day}^{-1}$) and intake as a portion out of total energy [10]. Different studies have been revealed that pregnant women require additional dietary protein than the recommended dietary protein for a normal female. [11].

Dietary recommendations of WHO and the Dietary Reference Intakes recommend a 20% to 35% of total calorie intake from fat. The minimum limit of 20% is mainly to ensure sufficient consumption of total energy, essential fatty acids, and lipid-soluble vitamins. The maximum limit of 35% is based on limiting saturated fat as higher the fat diets higher the consumption of calories, resulting in weight gain [12]. Current public health recommendations are implemented to lower dietary fat intake to reduce the increasing health problems related to obesity. [13]

The major research problem covered in this project is the determination of patient perception on hospital diet through a questionnaire survey and analysis of some basic components in the normal hospital diets of the National Hospital Sri Lanka (NHSL), Lady Ridgeway Hospital (LRH) and De soyza Maternity Hospital (DMH) in Sri Lanka. These three hospitals have been selected to represent adults, children and PW respectively. The analysis is focused to identify the nutritional quality of the diets. As these diets are provided to people who are not healthy, the diet plan should be well organized. Patient satisfaction is determined to evaluate whether the diets provided through the hospitals are able to meet the demands and expectations of the patients.

This paper is organized in sections as mentioned below: Section I contains the introduction on the background and significance of the study on quality and quantity evaluation of hospital diet, Section II contain the related work on the evaluation of hospital diet, Section III explain the

methodology employed in study design, sample collection and analysis, Section IV describes results and discussion of the survey and compositional diet analysis, Section V contains the recommendation of the study and Section VI concludes the research work with future directions.

II. RELATED WORK

Different studies at different times and various locations have shown the factors effecting patient satisfaction on hospital food service. Determination of patient satisfaction or the quality evaluation of hospital diet with regard to patient satisfaction has been done in a limited number of previous studies in Teaching hospital Karapitiya and National hospital, Sri Lanka [23, 24]. These studies focus on the lower consumption rates of hospital diets in government hospitals and have shown the importance of paying attention to hospital diet service in the research field. Also, these studies have shown that the hospital diet consumption depends on a number of factors like the diversity of meals, time of serving, temperature of foods, physical environment and specially the diagnostic condition of patients. There are no reported data on chemical analysis of hospital diet samples in Sri Lanka. In many other countries there are published data on hospital food service based on continuous assessment. These studies also have mainly focused on determining the perception of patients regarding food and nutrition care in hospitals [26,27,29,30,34,35,36].Also, most studies focused on food wastage at the hospitals [31,32,33]. These studies showed that there is a considerable food wastage as food remainders in wards and hospital kitchens at many hospitals. Determining patient perception and opinion on hospital diet and obtaining their feedbacks have shown significant importance in finding solutions for this issue. Many studies suggest to further evaluate hospital nutrition care in many countries. As there are still a limited number of published data on this area, the goal of this study is to basically determine the patient perception on hospital diet and determine the contribution of some selected components of hospital diets to the RDA of patients. Also, it is expected to contribute towards minimizing the food wastage at hospitals and uplifting the healthcare sector towards a healthy nation.

III. METHODOLOGY

This research was a combined study of an exploratory survey coupled with chemical analysis of diet meals in selected hospitals in Colombo, Sri Lanka, and was carried out in 2019 July-2019 December. The study sample for the exploratory survey was in-ward patients ($n=300$), while meals provided to them were used as study samples ($n=45$) for nutrient analysis.

Study area

This research was carried out in three major hospitals in Colombo Municipal Council, Sri Lanka, catering to three major patient groups. This location was selected because it is the largest local authority of Sri Lanka as well as the

main administrative and economic centre of the country. Also, Colombo district has grown into a large area that cater to the needs of a resident.

Ethical consideration

Before the initiation of the survey, ethical clearance was obtained from the Ethical clearance committee of National Hospital- Sri Lanka. Institutional approvals were obtained from the directors of each hospital. Informed consent was obtained from eligible patients who fulfilled inclusion criteria after the study purpose was explained to the patients or their guardians.

Validation of the questionnaire developed to determine the patient perception

The questionnaire was validated and developed prior to the survey. An exploratory survey was done prior to the proper survey to identify the suitable and efficient way of taking responses to the survey from patients. The preliminary questionnaire was developed and a sample population that was comprised of 30 general ward patients (n=30) from the three hospitals were taken as the respondents for the exploratory survey. The preliminary questionnaire was distributed among the sample population. The proper questionnaire was developed by using the details that were obtained through the preliminary questionnaire.

In the questionnaire, 100 general in-ward patients from each hospital were considered. Patients who had been consumed at least three main meals from the hospital were further questioned to determine the level to which they satisfy with the diets. Both groups of patients who consume the hospital diet regularly and irregularly were considered together in determining their satisfaction with the diet. The patients who were not on a normal diet and critically ill patients were not considered in the study.

The level of satisfaction was determined under four main score categories. The overall satisfaction was comprised of the level to which patients were satisfied with the taste, smell, texture, diversity, and quantity of the meals. The overall satisfaction for the meals was used for the analysis.

- Totally satisfied (score : above 8)
- Satisfied (score : 6 to 8)
- Accepted/ neither satisfied nor unsatisfied (score: 4 to 6)
- Not satisfied (score: below 4)

Sample collection and preparation

The samples of all food items given under the normal diet category were collected separately into cleaned and pre dried containers from Monday to Friday as per portions served to a plate of a patient [14]. Here only the normal full diets, normal half diets and pediatric diets were considered. Samples of breakfast, lunch, dinner were homogenized separately. Fresh weight of all the samples were recorded. Each sample was dried in an oven for 3 days at 60°C and the dried weight was recorded. Moisture contents were determined from the weight differences of

fresh and dried samples. Then dried samples were crushed using a blender and used for the further analysis processes.

Diet analysis

Moisture, salt, fat and crude protein of the samples were analysed using AOAC standard methods of analysis [15].

The moisture was determined using the oven method and calculated using the formula:

$$\% \text{Moisture content} = \frac{\text{weight loss}}{\text{weight of the sample}} \times 100$$

Nitrogen content of the samples was determined using the procedure described in the micro-Kjeldahl method.

About 1 g sample was weighed, heated and digested using concentrated sulphuric acid with the aid of Kjeldahl tablets as catalysts. The samples were heated at 420°C for 2 hours in the heating digester until the contents have become liquefied. The liquefied digest was then cooled and neutralized with 35.0 mL 33% Sodium Hydroxide. Then the solution was distilled into a 25.0 mL 4% boric acid solution [16,17]. The borate anions formed were titrated with standardized 0.1M Hydrochloric acid in the presence of methylene blue and methylene red mixed indicator, which was converted to nitrogen in the sample and calculated by the formula below:

$$N\% = \frac{[0.7 \times V(HCl)]}{M(\text{Sample})}$$

Where

$V_{(HCl)}$ = mean volume in mL of reacted 0.1 M HCl acid

M_{Sample} = weight of the dried fish sample in grams

N% was converted to crude protein content by multiplying N% by 6.25

Quality control: All glassware were rinsed with de ionized water and oven dried prior to the usage. Then they were allowed to dry under room temperature and used for analysis. A quality control sample, 'Indian market rice' was used to validate the method. The protein content of the sample was analyzed using the method mentioned in the procedure and validated accordingly.

Soxtec method, followed by three main steps, immersion, washing and recovery was used to determine the fat content. Initially the weights of empty flasks were measured. The final weights of the flasks to which fat was extracted after the process were measured.

The fat content was calculated as:

$$\% \text{fat} = \frac{[(\text{weight of flask} + \text{oil}) - (\text{weight of empty flask})] \times 100}{\text{weight of the sample}}$$

Quality control: All glassware were rinsed with de ionized water and oven dried prior to the usage. Then they were allowed to dry under room temperature and used for the analysis. Randomly selected five samples were used to

analysis fat in triplicate using the Soxhlet fat extraction method to validate the procedure. The AOAC (1985) Soxhlet method was followed to determine the crude fat content. Petroleum had been used for the extraction procedure [18,19]. Further, method was validated by using an 'Indian market rice' as the inter laboratory comparison. Salt (Chlorine as Sodium Chloride) was determined using Volhard volumetric Method described in AOAC, 2000. About 1.0 g finely powdered sample was treated with a 50.00 mL 0.1 M standard silver nitrate solution in the presence of 20.00 mL dil. HNO₃ acid. It was boiled on hot plate for about 45 min until all soluble solids were dissolved. Then it was cooled and filtered. The Filtrate was collected to a 250 mL volumetric flask and top up to the level with de ionized water. Exactly 10.00 mL of the solution was titrated against 0.1M standard ammonium thiocyanate solution until a permanent light brown color appeared in the presence of Ferric Alum Indicator.

Quality control: All glassware were rinsed with de ionized water and oven dried prior to the usage. Then they were allowed to dry under room temperature. A known amount of Sodium Chloride analytical reagent was added to five randomly selected samples in which salt was analysed previously. Final weight of samples were taken and the total amount of salt was analysed accordingly. Then the previously analysed amount of salt was deducted from the calculated total amount of salt value and detected whether the added amount of Sodium Chloride was correct. Hence the method was validated.

Statistical analysis

Obtained data from chemical analyzing of each sub samples for protein, fat, and salt for each hospital were statistically analyzed separately. Breakfast, lunch, and dinner sub-sample values were randomly combined to obtain a value per day. Data was converted per portion per day. All these components were analyzed in three times by taking the samples from three different spots. The sample size for each hospital was n = 15. Results were expressed as percentages for categorical variables and as mean ± standard deviation for continuous variables. The mean ± standard deviation values of protein and fat in the diet of each hospital were compared with the recommended ranges, respectively. One sample t-test was used to determine the significant difference of the mean salt in each hospital diet with the maximum recommended value. IBM SPSS version 23 for Windows and MS Excel 2013 For Windows used to perform all statistical analyses. A p-value of <0.05 considered as statistically significant.

IV. RESULTS AND DISCUSSION

Results

This study analysed the perception of patients on hospital diet in selected three major hospitals in Colombo, Sri Lanka, and compared the measured nutritional contents with the RDA of the respective age groups based on the dietary guidelines published by WHO/FAO.

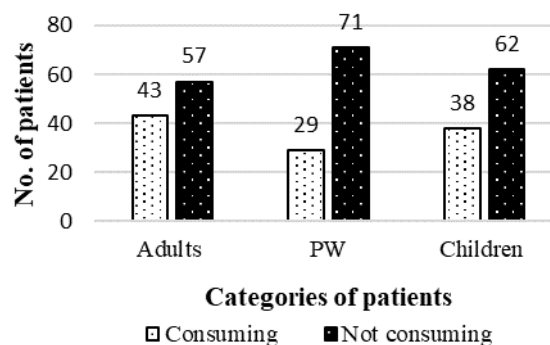


Figure 1. Consuming behaviour of hospital diet in three hospitals illustrating percentage consumption / non-consumption of adults, PW and children

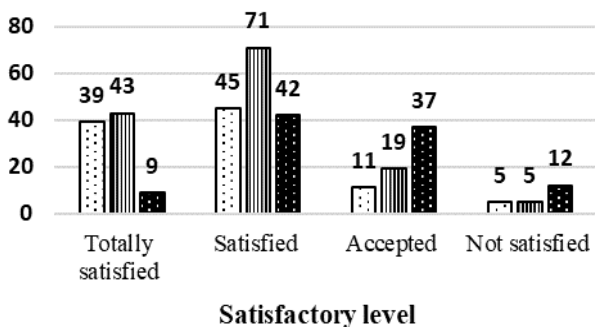
Figure 1 depicts that the consumption of hospital diet was less than 50%, which ranges from 43% - 21%. The lowest percentage was recorded from PW (21%) whereas the highest percentage was recorded from adults (43%). Among children, the percentage was 38%. The length of hospital stay of 89% PW participated in the survey was less than a week. Majority of them have a hospital stay of 2-3 days. For this short period of hospital stay, most of them get their food from home. It was found that the majority of patients (more than 50%) in all three hospitals whose residences are in close proximity to the hospital usually consumed food brought from home.

Out of the 100 patients who participated in the questionnaire survey from each hospital, patients who had consumed at least three main meals from the hospital were further questioned to determine their satisfaction about the hospital diet.

Table 1- General characteristics of the study sample in the survey analysis (n=300)

Characteristic	Number of respondents		
	Adults	PW	Children
Gender			
Male	42	0	51
Female	58	100	49
Age (years)			
1-2	-	-	13
2-4	-	-	23
4-6	-	-	12
6-8	-	-	19
8-10	-	-	13
10-12	-	-	9
12-15	-	-	11
15- 20	5	4	-
20-30	14	52	-
30-40	11	28	-
40-50	18	16	-
50-60	22	-	-
60-70	17	-	-
70-80	13	-	-
Duration of hospital stay			
Less than a week	73	89	82
More than a week	27	11	18

Table 1 shows the gender, age limit, and duration of hospital stay of 300 respondents in the survey analysis.



□No. of Children ■No. of PW ■No. of Adults

Figure 2: The distribution of the level of patient overall satisfaction (as a percentage) with the hospital diet in three selected hospitals in Colombo, Sri Lanka, Lady Ridgeway Hospital (LRH), De soyza Maternity Hospital (DMH), and National Hospital Sri Lanka (NHSL).

In our study, it was found that the consumption of hospital diet was less than 50%, but the majority of patients had an overall good satisfaction towards the diets provided to children and PW. According to figure 2, the percentages of patients having an overall good satisfaction (totally satisfied and satisfied) out of total patients consuming the hospital diet were recorded as; Adults: 51%, PW 83%, Children 84%.

Table 2 – The consumption of different portion sizes of major food items by respondents compared to the recommended serving portion sizes of Adults, PW, and Children under three scale categories [Scale1 (S1), Scale2 (S2), Scale3 (S3)]

Recommended serving portion size (grams)	Portion sizes frequently consumed (grams)	No. of patients consuming different portion sizes		
		Adults	PW	Children
Rice				
Adults/PW (300) Children (S1:180) (S2:120) (S3:90)	Less than ½ cup (<130)	0	0	4
	½ cup (65-70)	5	2	10
	1 cup (130-140)	8	15	18
	2 cups (260-280)	19	9	6
	More than 2cups(>300)	11	3	0
Pulses				
Adults/PW (140)	½ cup (65-70)	0	7	Not given
	1 cup (130-140)	17	21	
	2 cups (260-280)	26	1	
Vegetables				
Adults/PW(60) Children (S1:45) (S2:30) (S3:30)	1 table spoon (15)	0	0	21
	¼ cup (35)	7	4	17
	½ cup (65-70)	19	17	0

	1 cup (130-140)	17	8	0
Fish/Dried fish				
Adults (25-35)	10.5	9	2	17
Children (S1:25) (S2:15) (S3:15)	23	13	5	5
	58	14	19	8

According to Table 2, there is a considerable gap between serving portion sizes and the portion sizes which are more frequently consumed by patients. The pediatric diet plan is carried out where portion sizes are decided according to the age groups of children under three major scales [Scale 1(S1) for 6-12 years, Scale 2 (S2) for 2-5 years and Scale 3 (S3) for 9/12 months- 2 years].

Table 3 – The average percentages of food consumed by patients out of the served portion sizes per plate

Varieties of food items	% of Adults	% of PW	% of Children		
			S1	S2	S3
Rice					
More than served portion	25.58	10.34	8.70	0	0
Served portion	44.18	31.03	52.17	72.72	75.00
50% served portion	18.60	51.72	30.43	27.27	25.00
Less than 50% served portion	11.63	6.90	8.70	0	0
Pulses (chickpea/cowpea)					
More than served portion	60.46	3.44	Not given		
Served portion	39.53	72.41	Not given		
50% served portion	0	24.14	Not given		
Less than 50% served portion	0	0	Not given		
Vegetables					
More than served portion	39.53	27.58	0	0	50.00
Served portion	44.18	58.62	66.67	14.29	0
50% served portion	16.27	13.79	33.33	71.43	0
Less than 50% served portion	0	0	0	14.29	50.00
Fish/ Dried fish					
More than served portion	38.89	73.08	16.67	36.36	0
Served portion	36.11	19.23	50.00	54.54	100.0
50% served portion	25.00	7.69	27.78	9.09	0
Less than 50% served portion	0	0	5.56	0	0

In our study, it was found that normal diet plan of adults and PW consisted of pulses (chickpea and cowpea) at least

two days per week, which was highly appreciated by many patients. In the adult hospital, 60.46% patients were not satisfied with the served amount of pulses, 39.53% had consumed the whole served portion of pulses. In the maternity hospital, 72.41% PW had consumed the whole served portion of pulses, 24.14 % had consumed half the served portion size, and 3.44% had not satisfied with the portion size served. Out of total adult patients consuming the hospital diet (n=43), 59% males were not satisfied with the amount of portion size. As shown in table 3, considerable percentages of adult patients were not satisfied with the served portion size (Rice: 25.58%, Pulses: 60.46%, Vegetables: 39.53%, Fish/Dried fish: 38.89%).

Analysis of crude fat

FAO /WHO has provided ranges for total daily fat intake and the calorie intake from fat should be kept within those ranges. Furthermore, they have provided general guidelines for calorie intake based on a 2,000 calorie diet. According to the guidelines; 40 calories diet is considered as a low calorie content, 100 calories as a moderate calorie content and 400 calories or more as a high calorie content. According to FDA, the recommended daily calorie intake is 2000 cal. Each 1 g of fat is providing 9 calories [20].

Table 4– Mean scores of calorie values from dietary fat of hospital diets as percentages

Patient categories	RDA (% calories)	Sample size (N)	Mean ± SD
Adult	20-35	15	14.45±1.21
PW	20-35	15	21.13± 0.79
Children	25-40	15	18.80±1.11

Values are means of triplicate determinations. (p≥ 0.05).

According to Table 04, for adults, the mean percentage calories gained from fat (14.45 ±1.21) was not within the range of 20-35% which is the recommended range for adults (ages 19 years and older). The mean percentage calories gain from fat (21.14± 0.79) was within the range of 20-35%, which is the recommended range for PW (ages 19 years and older). For children, the mean percentage calories gain from fat (18.80± 1.13) was lower than the recommended range of 25% - 40% (ages 4 to 18 years 25-35% and ages 1 to 3 years 30-40% of calories from fat).

Analysis of protein in hospital diet

Protein content was calculated as absolute intake (g/day) and compared with RDA for Sri Lankans, 2007, Medical Research Institute to determine whether the hospital diet (n = 15) met the daily needs of different patient groups [21].

Table 5 – Mean scores of dietary protein values of hospital diets (g)

Patient categories	RDA (g/day)	Sample size (N)	Mean ± SD
Adults	52- 57	15	23.79 ±2.89
PW	59-65	15	57.14± 6.66
Children	1-2 years : 21 2-5 years : 26-29	15	32.17±2.89

Values are means of triplicate determinations. (p≥ 0.05).

For adults, the required range of protein (g) varies from (52–57) g/day for males and females, respectively. However, according to Table 05, the intake is only (23.79 ±2.89) g/day, which is only 51.31% of the lower limit of the range. In pregnancy, the daily requirement of protein ranges from (59-65) g, but our sample of pregnant women reaches the lower limit of the range by supplying (57.14±6.66) g per day. The daily requirement of protein for children varies from 21 g for 1-2 years and 26-29 g for 2-5 years of age for both males and females. Since pediatric diets provide (32.17± 8.33) g/day exceeding the range, the protein requirement is fulfilled for the specified age limits. For young children and adolescents, between 6-18 years of age, daily protein requirement varies from 35-85 g and 34-69 g for male and females, respectively. The menu reaches the lower limit of the required range, with a standard deviation of 8.33 g/day.

Analysis of salt

According to the recommendations of WHO, it is stated to consume less than 5 g of salt per day [22].

Table 6 – Mean scores of dietary salt values of hospital diet (g)

Patient categories	RDA (g/day)	Sample size (N)	Mean ± SD
Adults	≥ 5	15	7.06 ± 1.74
PW	≥ 5	15	8.53± 1.40
Children	≥ 5	15	6.58 ± 2.10

Values are means of triplicate determinations. (p≥ 0.05).

According to table 06, all three hospital diets provide a significantly higher amount of salt for patients. The mean differences between supply and required amounts are +2.06 g (p<0.05), +3.53 g (p<0.05), and +1.58 g (p<0.05) for adults, PW and children respectively.

Discussion

Food service can be used as one of the parameters to determine the quality standards of hospitals. Patient satisfaction can be assessed to determine the level to which patient expectations and needs have been achieved. Different studies show that the desire of patients to consume hospital food regarding their hospital stay was not that much good. Although chemical analysis of hospital diet has not been done in Sri Lanka, food quality regarding patient satisfaction has been done at the Teaching Hospital, Karapitiya [23]. This study showed that the hospital diet consumption was only 27% at the time of the survey. Similarly, the consumption of hospital diet in the hospitals that were considered in our study was less than 50%.

However, the overall satisfaction of the three patient categories about the diets was good. Pediatric patients have the highest percentage of overall satisfaction with the diet. The satisfaction of adult patients with the diet was less compared to other patients. A patient satisfaction study conducted in 2011 in NHSL also has concluded that patients of 21-50 years age group were significantly less satisfied with the hospital meals. From our study, it was

clear that patient satisfaction directly depends on the diversity of meals or the plate composition, taste, and aroma of foods. However, 16 adult patients out of 43 had accepted meals where they did not have an overall positive or either negative satisfaction towards the diet. In this study, some respondents were not willing to comment on the hospital food services because they consider hospital diet service as an extended service provided to them during their hospital stay. Although the satisfaction with diet is very low, the percentage of hospital food consumption is high among adults as depicted in Figure 2. It can be stated that adult patients have a good tendency to consume hospital diet than young children or PW.

Hospital diets should be provided concerning the demands of different patient groups to satisfy their expectations as possible. Overall satisfaction about diets depended upon sensory attributes, serving portion size, time of serving, temperature of serving, and many more. According to Fernando GHS and Wijesinghe CJ, the majority of people determine food satisfaction by two parameters such as taste and aroma of foods. Therefore, improving the taste and aroma to enhance appetite while providing hot and hygienic food in a timely manner can be stated as important points in the food service. Furthermore, it is stated that food service is a part of the hospital administration and depends on the competence of the medical officers in charge as they have the authority to prepare meal plans and control proper distribution to the patients as required. According to this study on the 'Patient perception on hospital food service at the Teaching Hospital Karapitiya', it has been found that only 13.6% of patients had an overall good perception on hospital meal, a majority had a fair perception while a considerable portion of the study sample (26.6%) were not satisfied with the overall food service. In addition, a recent study on 'The assessment of the quality of food service at a tertiary care hospital' revealed that the consumption of hospital diet was lower mainly due to unsatisfactory quantity, quality, and diversity of meals, unavailability of hygienic practices of staff, unavailability of physical and human resources [25]. In our study also it was found that the quantity, quality, and diversity of meals directly affect the level of satisfaction of patients about the hospital diet.

Sadaf *et al.*, (2018) have been highlighted that there are certain aspects that should be improved in the hospital food service, including increased food diversity, opportunity of food choice, enhanced quality and quantity of foods, healthy physical environment of the wards and staff hygiene [26].

A study carried out in East Malaysia evaluated the correlation between patient satisfaction level and the age limit of patients and the results show that there is a weak negative correlation between these two variables [27]. According to our study, the age limit and gender were significant variables in determining the food consumption pattern as a higher percentage of adult males consuming

the hospital diet but were considered as insignificant variables in determining overall satisfaction about the diet. However, it can be stated that the certain illness or health condition of patients significantly affects their food consumption and satisfaction. According to our study and previous studies, it was revealed that patient satisfaction depends on a number of factors that need to be periodically assessed in improving the hospital food service [23, 26].

The kitchen staff or the staff of the diet branch of each hospital take the necessary information of patients about their dependency on the hospital diet for the next day before preparing the food items for a particular meal. Therefore, food items are ordered and meals are prepared accordingly and send to particular wards. The information on the amount of each food item to be ordered for a particular patient is given under the food manual published by Sri Lankan Health Ministry (1995) [28].

However, the issue is that although the patients are informed that they are taking the hospital diet, whenever they get the meal from home or outside, they reject the hospital diet. On the other hand, plate wastage was also an issue. The remaining and excess portions of the wards finally ended as food waste. It was found that there is a communication gap between the kitchen and the wards regarding these diet issues. Therefore, it should be minimized as possible to reduce food wastage. From the results obtained, it was found that the food consumption of patients directly depended on their disease/health conditions. Previous studies show that different disease conditions change the food appetite of a patient to different levels and this reason has a direct impact on his food consumption [29].

In our study, the portion sizes of the patients were determined from the questionnaire by using a food model booklet. The maximum amounts of food items that are served on a plate of a patient as recommended in the food manual (1995) published by the Ministry of Health, Sri Lanka, were taken as portion sizes and the nutrient content was calculated accordingly. Portion sizes given for the normal full diet and pediatric diet were taken into consideration. However, most of the time patients do not consume all food stuffs given to a plate or some do not satisfy with the portion sizes given.

Sometimes both the guardian and the patient were sharing the same plate in pediatric wards. Therefore, the determination of more frequently consumed portion sizes by the patient is obvious to understand the gap between serving and consuming portion sizes and to get an idea about the plate wastage.

According to Hamilton and colleagues (2002), different studies show that there is a gap between the quantity of food consumed and the quantity served [30]. Comparably, in the study by Barton and colleagues (2000), it has been shown that hospital resources mostly ended in wastage including food remainders at the wards [31]. Plate wastage

is a serious issue in many medical institutes. Different studies show that most patients do not consume considerable portions served to them and these portions ended as food wastage [32,33]. The portion sizes are given for raw food items in the Food Manual by the Ministry of Health, the weight of each food item is changed upon cooking. Therefore, information on the recommended portion sizes that were served to a patient was obtained from hospital kitchens accordingly.

The gap between serving and most frequently consumed portion sizes is necessary to study as there is a considerable food wastage at the hospitals. The pediatric hospital has a better coordination between serving portion size and food consumption because servings are done according to the age categories of patients. However, poor taste, food being excess, inability to eat because of the disease condition, and loss of appetite due to the health condition were the prominent reasons identified as major causes for plate wastage.

The 'Australasian Nutrition Care Day Survey' (ANCDs) was the first multi-center study across Australia and New Zealand which has been reported the correlation between nutrient intake, hospital stay, and other health outcomes of patients. It has been reported that patients who consumed <25% of hospital diets have a longer duration of hospital stay and mortality rates [34]. Dupertuis *et al.*, 2003 had shown in their study that in-ward patients did not consume adequate amounts of nutrients to satisfy the RDA and only 36.7% of in-ward patients with a longer duration of hospital stays consume more than 50% of the meals they were served [35]. Another study conducted by Kim *et al.* also had shown that there is a direct connection between the length of hospital stay and food consumption [36].

The chemical analysis of hospital diet samples reveals that the salt content of samples exceeds the daily recommendation for all the patient categories. The salt content in food is now of high concern as it directly effects the increasing risk of NCDs. The increasing salt content in hospital diet may influence the patient recovery directly. Only children and maternity hospital diets fulfill the RDA of proteins and only in the maternity hospital, the percentage calories from fat 21.14 ± 0.79 was within the range of RDA. However as it is catering to three different patient categories, it is unable to compare the quality standards of diets in the three hospitals considering the patient satisfaction. But considering how the diets fulfill the daily recommendations of each patient category, the maternity hospital diets fulfill the nutrient requirements of protein and fat.

However Hospital diet is necessary to uplift the health condition of a patient. Therefore, continuous food assessment is significantly important. The results of this research will be helpful to MOH, Sri Lanka in policy making and for increasing public health awareness as well as improving the quality of health care services.

V. CONCLUSION AND FUTURE SCOPE

It can be concluded that the quantity of meals (portion size), quality of meals, and sensory attributes like taste, aroma, and texture of meals matter for food consumption and satisfaction of patients. Furthermore, the health conditions and treatment processes of patients have a direct impact on their food consumption regardless the patient category. From our study it was concluded that the consumption of hospital diet was less than 50% for all the three patient categories. But in overall the satisfaction about the diets was good. As the diet plan is carried out based on a scale depending on age categories, the children hospital had a better coordination between the quantities served and quantities eaten. In spite of sufficient food provisions, mainly adult patients did not cover the recommended daily needs of fat and protein through hospital diet. For PW and children, the hospital diet fulfilled more than 50% of daily fat and protein recommendations. For adults, PW and children, daily intake of salt was considerably higher through the hospital diet than the recommended daily intake. In general the nutrient composition of food items varies upon the method of cooking, time of cooking, and other factors in the preparation of meals. Therefore, food assessment regarding nutrient composition should be a continuous process which needs to be done to enhance the quality standards of diets. This study has a few limitations. Some patients were not consuming the hospital meals regularly while some were consuming regularly. The perception of these two groups would not have been comparable with each other. Still, both of these groups were viewed together in determining overall satisfaction about the diets. The parameters like time of serving, temperature of foods, staff/ service issues, and physical environment which affect food consumption and perception were not considered in this study. Therefore it is suggested to improve the evaluation of hospital diet service considering these factors while implementing a periodic assessment of the nutrition care of patients.

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