REDUCING PROTEIN WASTAGE AMONG SURGICAL AND ONCOLOGY PATIENTS ON HIGH-PROTEIN DIET IN HOSPITAL PAKAR SULTANAH FATIMAH, MUAR

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Abstract

Surgical and oncology patients with ongoing treatment require a high-protein diet (HPD). Traditionally, in *Hospital Pakar Sultanah Fatimah* (HPSF), an indicated HPD patient was served up to four types of protein food (PF) per serving, leading to high food waste. In hospital settings, food wastage signifies inadequate nutrient intake and is linked to the cost and environmental impact. In HPSF, 63.5% PF wastage was recorded in 2019. A two-cycle-quality improvement study was conducted between January 2019 and February 2020 among all eligible surgical inpatient and oncology daycare patients prescribed HPD. The indicator was the percentage of protein wastage, with the standard set at 26% or less based on established evidence. A survey collecting demographic data and food satisfaction surveys was conducted. Pre and post-meal PF were weighed and recorded in a log sheet. The results, analysed using SPSS version 23, showed a protein wastage reduction from 63.5% to 56.8% and then further reduced to 27.5%. Associated factors were excessive PF servings, hospital food rejection, unstandardised HPD, missed updated diet order, limited acceptance, and mealtime duration. The strategy in the first cycle involved the reduction of PF from four to two types per meal, the development of a standard recipe, and training for food services staff. During the second cycle, PF was distributed evenly between four mealtimes. Dietitian assessment and evaluation were made compulsory for HPD prescription before ordering. Oral nutrition supplements were offered as meal replacements for patients with eating difficulties. The remedial measures were expanded to all wards in HPSF. Future efforts may include software usage to standardise HPD preparation, online diet ordering, diet cancellation stickers on patients' bed head tickets, development of a menu book, and compact meal development.

KEYWORDS: Protein, high-protein diet, hospital food waste, dietitian, quality improvement study

Problem

A high-protein diet (HPD) supplies more than 20% of total daily calories (1) and is a key Medical Nutrition Therapy (MNT) component for surgical and oncology patients to support wound healing, prevent malnutrition, and preserve muscle mass (2,3). In Malaysian government hospitals, daily diets follow the Hospital Diet Manual 2016, providing 40g (low-protein), 60g (standard), or 90g (high-protein) options tailored to meet patient needs based on dietitian assessments (4). This aligns with the European Society for Clinical Nutrition and Metabolism (ESPEN)'s guideline recommending a daily protein intake of 1.0 to 1.5 g/kg ideal body weight (60–90g/day minimum) during illness or stressed conditions (5,6).

However, translating these clinical recommendations into daily practice presents significant challenges. A verification study conducted in January 2019 at *Hospital Pakar Sultanah Fatimah* (HPSF) revealed that 63.5% of the protein served to high-risk patients was unconsumed and discarded, with 53.0% of patients eating either nothing or only up to one-third of their meals. This high HPD wastage signifies inadequate protein intake, which compromises individualised MNT plans (7) and results in an inefficient use of government resources (8,9).

This clinical and operational gap directly impacts HPSF in Muar, Johor, a 550-bed specialised district hospital with 22 multidisciplinary wards. High-protein meals are heavily utilised in HPSF's surgical wards and its daycare unit, the *Pusat Rawatan Onkologi Yayasan* (PROY), which delivers chemotherapy to Northern Johor oncology patients from Tangkak and Segamat.

These specialised meals are managed by HPSF's Dietetic and Food Service Department (DFSD), which consists of the Dietetic Services Unit and the Food Services Unit, staffed by eight dietitians, one catering officer (CO), five assistant COs (ACO), and 28 *Pembantu Penyediaan Makanan* (PePM). Dietetic Services manages therapeutic diets, diet consultations, and enteral nutrition while Food Services operates eight cycle menus. Inpatients receive four meals daily, and daycare patients receive one main meal. While normal diets provide 14g of protein per main meal, HPD patients receive three to five protein-based foods (PF) per meal (delivering up to 35g of protein). PF served are chicken, fish, egg, tofu, fermented soybean (tempeh), fried potato patty (*begedil*), and protein jelly. Due to these additional PFs, HPD meals incurred higher production costs; in 2018, DFSD served 17,264 HPD meals totalling MYR120,848 (USD27,319.19 as of January 2019).

To address this significant gap between meal production expenditure and actual patient consumption, this quality improvement study aimed to reduce protein wastage in our setting to equal to or less than 26% (≤26%) in accordance with ESPEN guidelines (10).

Background

Protein is a macronutrient that plays a significant role in cell and tissue repair (1). It can be divided into HBVP and low biological value proteins (LBVP). The higher biological value indicates better efficiency in being turned into body tissues once absorbed from the gastrointestinal tract (1). Protein consumption is essential for wound healing (2), supporting muscle synthesis in cancer patients, and reducing malnutrition risk (11). Inadequate intake can increase muscle loss, higher infection rates, slower wound healing, and extended hospital stays (12,13). These repercussions of malnutrition significantly influence hospital resources and healthcare expenses (14).

In a hospital setting, the type of protein prescribed varies depending on the individual patient's medical condition, nutritional needs, and dietary restrictions. It included lean meats, fish, dairy products, eggs, legumes, nuts and seeds, tofu and tempeh, protein powders, protein-enriched foods, and oral nutrition supplement (ONS) (4,15). Protein-enriched foods may include specialised enhanced foods like protein bread, bars, ice cream, jelly, or snacks designed for patients with high protein needs (15). ONS is a multi-nutrient liquid, semi-solid, or powder product that contains macronutrients and micronutrients (16).

Food waste refers to the uneaten food that remains after being served to patients in a hospital (8,10). A recent systematic review reported that hospital food waste can account for 20–74% of all hospital trash (17). Data from two Malaysian public hospitals in 2018 indicate that the

problem may be even greater locally, with up to 86.7% of meals served being discarded (18). According to Barton et al. (19), food waste exceeding 40% was associated with lower protein energy intake and weight loss during hospitalisation, highlighting the nutritional risks of excessive plate waste.

Hospital plate waste is a multifactorial problem influenced by patient-related factors, poor meal experiences, large meal portion size, limited menu variety and patient choice, inadequate staff training and resources, and lack of staff engagement in optimising patient meal care (20,21). In cancer patients, Nurshariza et al. (17), reported that nausea, vomiting, loss of appetite, and swallowing difficulties have been shown to significantly increase food wastage.

To address these issues, a variety of strategies have been implemented. Standardising meal portions can better align meals with patients' appetites and improve acceptance. Jonathan et al. (22) demonstrated that implementing portion size standardisation in the inpatient setting reduced mean plate waste from 70.2% to 65.8%, a reduction of 4.4%. In addition, providing protein and energy-fortified snacks in between meals has been shown to significantly increase daily intake among hospitalised patients, with protein intake rising from 49% to 88% of individual requirements, suggesting that targeted nutritional strategies beyond main meals can further support intake and potentially reduce plate waste (23).

Furthermore, staff training has been identified as a key strategy, with healthcare professionals emphasising the importance of formal training in plate waste assessment, accurate diet ordering, and management of therapeutic diets to prevent errors and ensure that meals meet patients' nutritional needs (21).

Measurement

This quality improvement study was conducted between January 2019 and February 2020 in two selected surgical wards (Ward 4 and Ward 5) and a daycare (PROY). All patients intended for HPD orally were included, as the number of patients requiring HPD is a small and well-defined population. Patients with communication barriers, unwillingness to participate, less than 18 years old, and requiring a combination route of feeding via enteral or parenteral were excluded.

The indicator used was the percentage of protein wastage, with the standard set at ≤26% based on a narrative review carried out in 2011 that summarises the results of 32 studies across 29 countries over the past 50 years and published as ESPEN guidelines (10).

The indicator formula is below:

$$\textit{Percentage of protein wastage} = \frac{\textit{Amount of protein content in PF wastage from HPD}}{\textit{Amount of protein content in PF from HPD served}} \times 100$$

The wasted PF value was obtained from a few weighing steps. At baseline, cooked PFs for every HPD were weighed pre-meal, using a digital scale in the kitchen, and labelled with the patient's name before serving to the patients. The weight of the different types of PF was recorded separately, such as the weight of chicken, fish, egg, etc. Post-meal, the labelled meal trays were collected. Then, the non-edible and edible parts were separated before being weighed. Wasted PFs were obtained by subtracting the weight of non-edible parts in the leftovers from the weight of the pre-meal PF serve. The protein content of each protein food type was estimated by referring to the Malaysian Food Composition Database (24). Data analysis was performed using SPSS version 23. Findings from the verification study involving 48 subjects revealed that the percentage of protein wasted was 63.5%, which warranted intervention.

Data on contributing factors were collected using a content-validated questionnaire adapted from the Patients' Diet Satisfaction (KKP) form by the Ministry of Health (25), administered by dietitians and COs. The questionnaire (Appendix 1) consisted of three parts. The first part gathered information on patient admission and demographic data. The second part explored patients' disease, treatment, nutrition impact symptoms, ONS consumption, food intakes other than hospital meals, and knowledge of HPD, such as the type of meals served and their importance. The third part consisted of patient satisfaction with HPD using a 5-point Likert Scale, with five denoting the highest

satisfaction. In addition to the KKP survey, an audit of compliance with the standard recipe preparation was conducted by senior dietitians and COs during food preparation at DFSD to determine conformance to the criteria set in the Model of Good Care (MOGC). Data was captured in the Standard Recipe Compliance Audit (*Audit Pematuhan Resipi Piawai*) form (Appendix 2) developed by the DFSD's Menu Committee.

Following that, strategies for change in the first cycle were implemented from February until April 2019, followed by data collection post remedial in May - Jun 2019 with 180 subjects. Remedial action in Cycle 2 was started in July until December 2019, followed by the post-remedial data collection with 152 subjects using the same method in January - February 2020.

Initial Assessment of the Problem

The process of care on HPD distribution initiated with the doctor's assessment and plan for HPD once the patient was admitted to the ward (Figure 1). HPD were ordered by nurses based on the doctors' plan or automatically based on patients' medical diagnoses, such as cancer, head injury, post-operation, or burn, or even the dietitian's assessment. This had led to excessive PF being served despite patients' inability to consume their meals accordingly, as they were not properly assessed by the dietitian. For example, in the verification study, HPD patients received a double portion of PF (two pieces of chicken) or multiple PF in a meal, such as one piece of chicken, one piece of tofu, one whole egg, and a cup of protein jelly for lunch, which led to difficulty in finishing the bulky or multiple meals.

The printed or hand-written diet order forms were sent to DFSD before 8 am. Any changes to the diet throughout the day will be informed through a phone call or submission of a new diet order form. However, updates of patients who required diet changes, such as Nil by Mouth (NBM) and discharged, were seldom reported to DFSD.

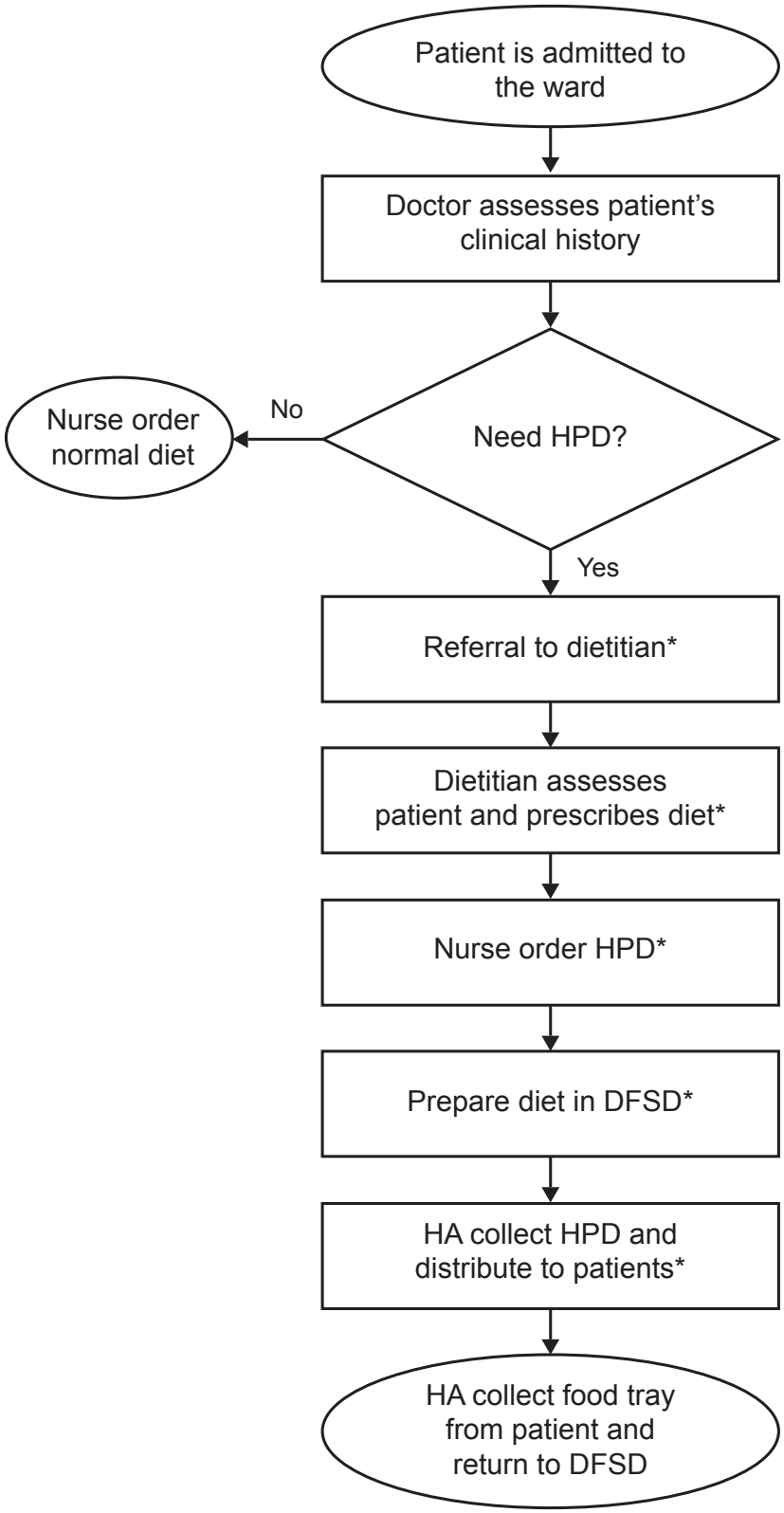
Once an order is received, DFSD staff will prepare HPD. The food preparation method differs for every PePMs as some do not comply with the standard menu, resulting in different tastes or results of the same menu. HPD were distributed based on the patient's diet tagging, and hospital attendants (HA) will transfer the meals by trolley from DFSD to wards and serve them to the patient. Patients were given around one hour to finish their meals, but the food trays were always taken away early to return to DFSD.

During dietitians' ward rounds in the surgical ward and PROY, it was observed that some HA placed food trays on the side table without alerting sleeping patients. If the meal was overlooked, it was subsequently return uneaten to the DFSD. Consequently, patients missed their meal upon awakening or returning from medical procedures. In addition, patients requiring feeding assistance sometimes experienced inadequate support likely due to competing demands in the busy ward environment.

MOGC, shown in Table 1, were developed from the critical steps in the process of care. From the audit, only 80.0% of patients receiving HPD were referred to a dietitian. Patients with ongoing chemotherapy were automatically enrolled on HPD after assessment by the doctor. Thus, the remaining 20.0% of patients were not assessed and not provided with suitable nutritional intervention by a dietitian. Only 50.0% of the indicated patients received ONS, while this patient still received a normal diet or HPD, even though they could not finish the meals.

Compliance with HPD standard recipes was limited, given that the recipes were rigidly documented in standard recipe books. Besides that, based on the dietitians' audit, only 60.0% of the hospital meals were distributed accurately by the HA. There were incidents where HA swapped patients' meals as requested by patients, causing the wrong meals to be served to the remainder of the patients.

The problem analysis chart in Figure 2 showed factors that can contribute to the high percentage of protein wastage among surgical and oncology patients.



*indicates critical steps

Figure 1: Process of care for HPD serving

Table 1: MOGC of HPD serving

No.	Proses	Criteria	Standard	Pre-remedial phase	Post remedial study (Cycle 1)	Post remedial study (Cycle 2)
1.	Referral to a dietitian	The doctor referred all patients who needed dietary support for individualised advice	100%	80.0%	100%	100%
2.	Dietitian assesses patients and prescribes a diet	The dietitian does a nutrition assessment and prescribes HPD if required	100%	100%	100%	100%
		Dietitian gives ONS as a meal replacement (as needed/if required/as indicated)	100%	50.0%	50.0%	100%
3.	Nurses order HPD	Nurse orders HPD based on the dietitian's prescription in the diet order form and send to DFSD	100%	87.5%	No data	91.0%
		Nurses update diet order for NBM or discharged patients	0.0%	100%	100%	95.0%
4.	Prepare the diet in DFSD	PePM prepare food based on a standard recipe	100%	0.0%	0.0%	64.0%
5.	HA collect HPD and distributes it to patients	Diet is distributed based on tray tagging	100%	60.0%	No data	95.3%

The first factor involved patients' difficulty in finishing excessive PF servings in a meal. Excessive PF means patients receive two or more servings of PF. In the verification study, it was found that on average, HPD with two PF had a wastage rate of 68.0%, while HPD with more than two PF recorded higher wastage at 74.0%. They were 12.5% HPD ordered without a dietary assessment by the dietitian.

The second factor was patients' condition with limited food acceptance due to symptoms of disease, including altered gastrointestinal function, such as loss of appetite (36.0%), nausea (18.0%), and early satiety (12.0%), was observed. No caregiver to assist with feeding, symptoms of disease, side effects of medication, an unconducive ward environment, and unfavourable PF selection caused the patient's limited food acceptance.

The third factor was patients refusing hospital food. Patients refusing hospital food had significantly consumed outside food (x^2=27.4, p<0.01). It was found that many patients' carers brought outside food from home or restaurants. The verification study found that 75.8% (n=36) of patients' carers brought food from outside, and 64.0% (n=22) of patients did not eat the respective meals during the study, either lunch or dinner. The other contributing reasons were unfavourable protein selection, less encouragement to consume the hospital diet, missed food allergy notification, negative perception of hospital diet, and lack of knowledge of HPD.

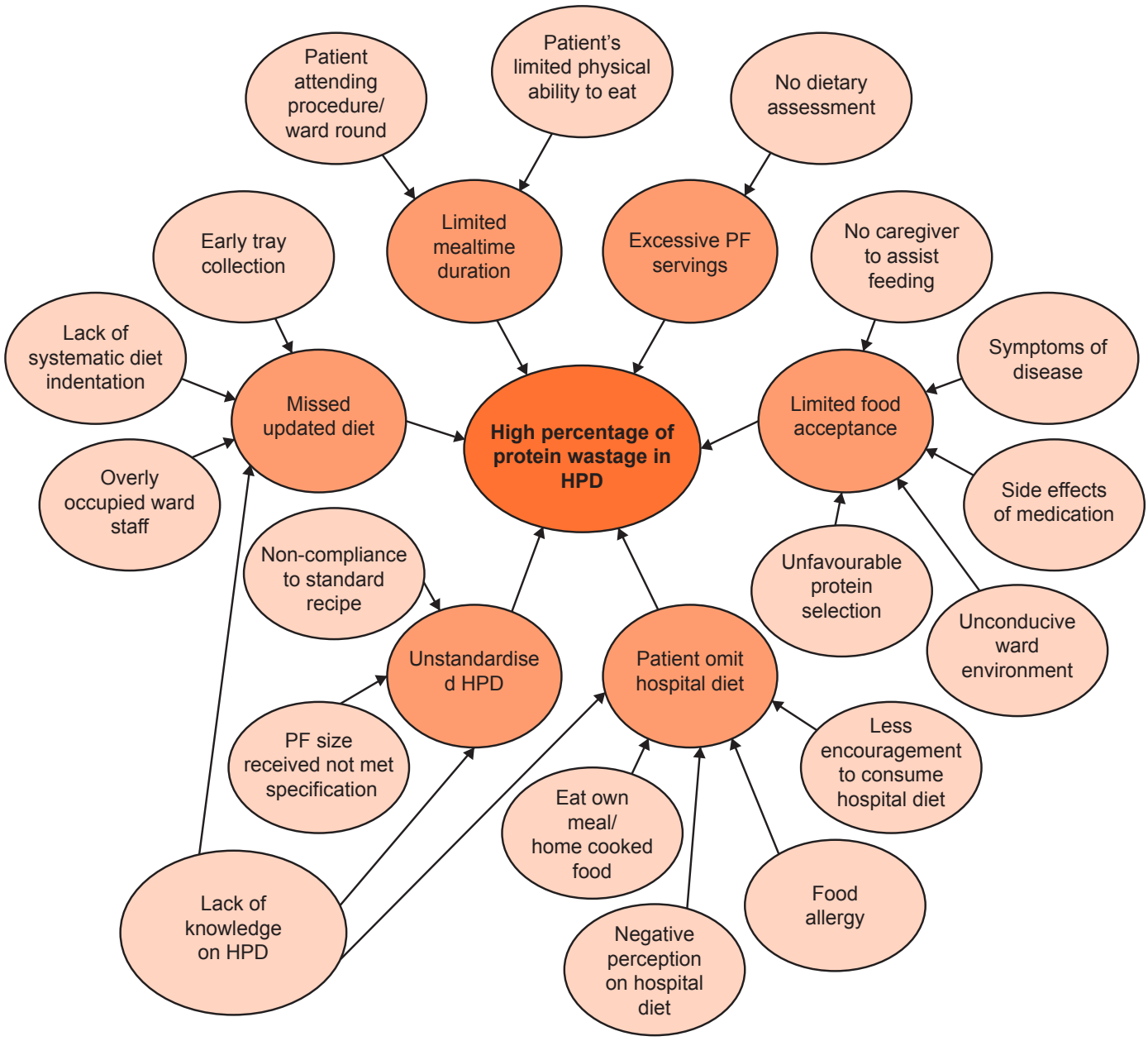


Figure 2: Problem analysis chart of contributing factors to high percentage of protein wastage in HPD

The fourth factor looked at the meals that were not prepared as specified due to non-compliance with standard recipes or the method of cooking used, which contributed to the low quality of HPD. The customer satisfaction scale showed taste, aroma and portion less than standard (<2.5). The PF portion size received from vendors did not meet the specification. The size of the cut chicken received was inconsistent, with 30.0% of the pieces being larger than the standard. Lack of PePM knowledge (57% pre-test mark) also led to improper giving of the PF portion during food plating.

The fifth factor was the failure to update the diet order. We observed a lack of HPD knowledge among ward nurses from the assessment during nursing training sessions (pre-test mark 58.0%). During random interviews in the ward, nurses complained of being overly occupied with patient care, leading to failure to update diet orders before every meal, especially for NBM, discharged or deceased patients. In our hospital, diet orders were processed manually with only two times of form submission per day. Any diet changes require nurses to inform DFSD within the allocated time. Lack of a systematic ordering system contributed to this factor.

The sixth factor was limited patient mealtime duration. Patients with limited physical ability to eat require longer mealtime. The standard eating time is one hour. Earlier tray time collection reduced meal duration to approximately 30 minutes. Mealtime was also disrupted for patients who had to undergo procedures such as blood tests and X-rays.

Strategy

The strategies were carried out in two cycles: four in Cycle 1 and five in Cycle 2. In overcoming patients' limited ability to finish a meal set with multiple PFs, the first strategy we looked at was modifying the number of PFs served. We reduced the amount of PF from multiple types to two different types only and avoided giving a double portion of PF. It suits the condition of surgical and cancer patients on treatment who are unable to consume large amounts of food (26).

The second strategy was the innovation of Jelly Hi-Pro, a protein-dense jelly. From the unstandardised and plain jelly, we improved the presentation, taste and provided a standard recipe. We changed the preparation step by adding 5g of whey protein powder in the last step after the mixture was distributed into the mould to avoid a total protein content reduction in total protein intake for HPD. Therefore, the quality and quantity of the protein were maintained and standardised. The flavour was enhanced with corn, pandan and *gula melaka* flavours to increase patients' tolerance. Jelly Hi-Pro is a protein-dense meal that helps patients meet their protein requirements more efficiently and avoid inefficient PF costs (27). Jelly Hi-Pro cooking demonstrations were organised for other PePMs to ensure preparation as per the standard recipe. Jelly Hi-Pro is served during afternoon tea as a supplement/additional PF to complement the first strategy.

The third strategy was the production of a standard recipe for HPD and increased compliance towards standard preparation by PePMs. A series of high-protein recipe modification meetings was held among dietitians, COs, and senior PePMs to develop standard recipes and protocol to monitor compliance of PePMs in HPD preparation. Among the HPD recipe modifications were *roti john*, egg sandwich, bread pudding, mushroom soup, egg casserole, and mung bean porridge, added with protein powder.

The fourth strategy was Continuous Catering Education (CCE) on HPD preparation among DFSD staff. The four sessions of CCE involved all PePM and were essential to explain HPD benefits and encourage compliance towards standardised recipes and protocol. PePM were emphasised to use ingredients measured by the catering officer for each menu and refer to the standard recipe book during meal preparation. PePM were also trained on the correct PF portion size and the importance of serving the diet correctly. A dietitian and a catering officer also conducted a monthly standard recipe compliance audit for HPD preparation using the form as in Appendix 2.

In the second cycle, the fifth strategy was strengthened due to minimal reduction of protein wastage during the Cycle 1. Instead of two different types of PF given in each lunch and dinner, in the fifth strategy, only one PF type or portion was served during the main meal, and we also distributed PF during breakfast and afternoon tea. Appendix 3 showed, a patient received one serving of shredded chicken for breakfast, a piece of chicken for lunch, one serving of scrambled egg for afternoon tea, one piece of fish for dinner and 1 sachet of low-fat milk as a drink for breakfast and afternoon tea. It contains 14g of protein in each meal time, with a total of 56g of protein in PF. The total estimation of protein served is 78g per day for HPD.

Our sixth strategy in Cycle 2 was making nutritional assessment compulsory for each patient requiring HPD. Thus, doctors are required to refer to a dietitian for nutritional assessment and appropriate high-protein dietary modification. Furthermore, the practice of automatic HPD indentation for chemotherapy patients was discontinued. Based on nutrition assessment, patients were given the chance to choose either chicken, fish, egg, or vegetarian for their next meal based on their preference. Patients who had difficulty finishing the food served were offered ONS. A circular letter endorsed by the hospital director regarding this new procedure on management of patients requiring HPD in surgical wards and PROY was distributed to all respective heads of department and nursing units.

The seventh strategy in Cycle 2 was complementing patients with limited food acceptance during chemotherapy at PROY. Those who were unable to tolerate food due to altered patient's smell and taste, and altered GI function were offered ONS as a meal replacement during their day care treatment. High-protein and calorie-dense ice cream was provided together with meals to all patients who received HPD.

The eighth strategy involved HPD training and education for nurses and HAs given by dietitians. They were educated on the importance of HPD for patient outcomes, as well as the need to encourage patients to finish their HPD meals. Mealtimes should be prioritised over other procedures to minimise protein wastage. HAs was instructed to avoid collecting food trays earlier. The training also highlighted the importance of ward staff in ordering HPD correctly after being prescribed by a dietitian. Objectives were to improve understanding of diet as part of treatment, and to increase awareness about updating dietary changes for patient discharge and NBM. The percentage of attendees with good HPD knowledge improved from 49.0% (pre-test) to 77.0% (post-test).

The ninth strategy was conducting "Eating Hospital Diet" Awareness Campaign, which was launched during the Dietitian Day celebration on 26th September 2020 at the foyer, HPSF Muar. The awareness campaign was organised to tackle the public's perspective on avoiding eating hospital food and patients' practice of bringing outside food found in our verification study. During the campaign, 200 participants including caregivers, hospital staff and the public had the opportunity participate in a hospital food tasting on the breakfast and lunch menus. The visitors gave positive feedback, and this campaign changed the misconception that hospital food is tasteless or has medication added to it.

Results

Our main outcome measure on the percentage of protein wastage was successfully reduced from 63.5% (n=48) to 56.8% (n=180) and 27.5% (n=152). The Achievable Benefit Not Achieved (ABNA) results are shown in Figure 3.

Following the remedial measure, MOGC in Table 1 showed that the results of dietitian referral by doctor were achieved 100% with all patients' needs HPD was referred or informed through phone call or an indent form. Nutrition assessment had been performed for all referred patients,

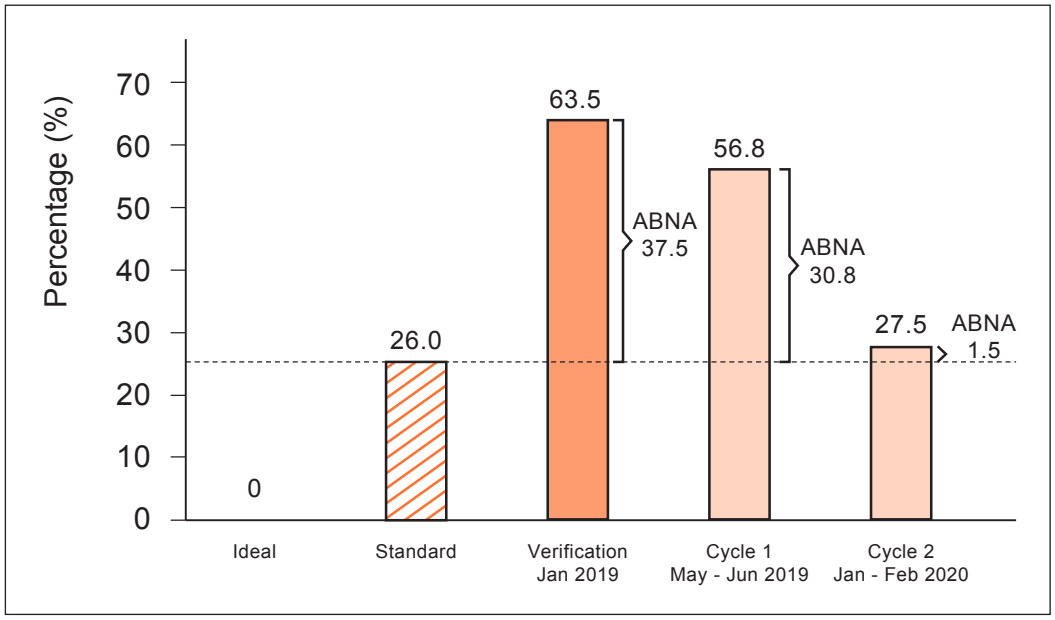


Figure 3: The trend of the percentage of food wastage and the ABNA gap across the cycles

and ONS prescription as a complementary or meal replacement was achieved. Nurses' compliance with HPD ordered as prescribed by the dietitian was improved to 91.0%, but a few nurses did not adhere, as the information provided during training sessions was not fully disseminated. PePM compliance with the standard recipe and protocol was improved to 64.0%. A food satisfaction survey on patients also showed improvement. Smell, taste, and portion size had a low score (scale <2.5) and were improved in Cycle 2, with all criteria having a score >3.0 except smell. Portion size, food temperature, freshness, presentation, food variety, texture, taste, and meal serving time achieved an excellent rating (score=5.0). Criteria for diet served based on tray tagging had nearly achieved the standard (95.3%).

Lessons and Limitations

This study taught us that reducing PF wastage is possible by improving the work process involving food preparation staff, dietitians, and ward staff. Distributing PFs to four mealtimes throughout the day helped patients with limited food acceptance and early satiety to appreciate smaller protein food portions at four separate mealtimes. Dietitians individualised nutritional assessments and interventions also played a role in suitable diet orders and helped reduce PF wastage.

Creating a standard recipe and a modified type of protein received, provision of ONS as a meal replacement, and continuous training sessions to staff dealing with PF from preparation until serving may further contribute to the reduced PF wastage. Reduced PF wastage was achieved through the commitment and cooperation of the hospital management, DFSD staff and ward staff. Awareness of the importance of nutrition in the recovery process is important at every level of staff and not only at the dietitian's role. All hospital workers must play a role to ensure adequacy of food intake and thus reduce food wastage among patients.

We conducted a universal sampling due to the limited number of the population of HPD patients in our hospital. This approach allowed us to include all available cases, ensuring comprehensive data collection while minimising potential sampling bias. However, the findings may have limited generalisability to broader populations, and future studies with larger, more diverse samples are recommended to validate our results. Another limitation was that in the study, we encountered several problems when using the HPD menu. With the new creation of the menu, some of the menu items cannot be sustained due to the unavailability of raw food. Therefore, it was challenging to create an HPD menu within the available raw food storage. Due to a lack of exposure and experience in QA activity, we failed to measure the magnitude of the critical steps of nurses ordering HPD, HA collecting HPD and distributing it to patients. In order to understand the root cause of each problem, we did not verify the criteria in MOGC during the first cycle. In the future, we should get proper guidance from the QA/QI committee to prevent a shortfall in the study.

Findings from this study were presented during Dietitian Day at HPSF in 2020, Johor Innovation and Quality Convention 2021 and National Quality Assurance Convention 2022. This quality study suggests that dietary assessment before HPD indentation is critical, standard preparation and appropriate PF distribution in meal planning, as well as ONS prescription for limited acceptance patients are among the main key findings.

Conclusion and the Next Steps

Hospital food wastage, specifically protein wastage, is common and has been reported to occur in all hospitals. The percentage of protein wastage in HPSF found during the verification study was high (63.5%). With multiple strategies, protein wastage was reduced to 27.5%, close to the standard aimed at ≤26%, and the ABNA was reduced from 37.5% to 1.5%, as in Figure 3. Several main contributing factors were identified, which were excessive PF servings, patients' limited food acceptance, avoiding hospital diet, unstandardised HPD preparation, missed updated diet order, and limited mealtime duration. Thus, we executed several strategies within two cycles. Remedial actions focused on dietary adjustments, including increasing serving sizes, distributing PF throughout the day, and introducing Jelly Hi-Pro and new HPD

recipes. Additionally, we strengthened operational standards by enforcing cook compliance with new protocols and providing continuing education (CCE/CNE) for DFSD staff and nurses. Furthermore, automatic HPD ordering was discontinued. All HPD orders, meal replacements with ONS, and other dietitian-planned MNT strategies now require a prior dietitian referral for nutritional assessment.

For this study to be more clinically significant, we would like to suggest that other researchers conduct a clinical study. It is important to assess the 24-hour dietary intake of patients as well as their muscle strength and the length of hospital stay. Furthermore, it will allow us to compare any association between protein wastage, protein intake and the clinical outcomes.

In future, we plan a few strategies to sustain the result. Currently, our department is developing an innovation project, a software that could automatically calculate the quantity of ingredients required in preparing daily meals for real patients. Therefore, we hope that compliance of PePMs with the HPD standard recipe will improve.

Secondly, online diet ordering should be developed to manage diet changes easily, e.g. diet indent cancellation upon patient's discharge. Third, a sticker should be placed on the bed head ticket of patients to alert doctors and ward staff to cancel their diet if the patient has NBM or is discharged. Fourth, we would like to develop a menu book as a reference for patients to choose their food. A patient can request PF depending on their tolerance based on the daily menu. Fifth, we plan to standardise our dietary plan and create options of small-sized meals or compact meals for patients who refuse to eat hospital food or receive ONS more than 70.0% of their daily energy requirements. However, monitoring by a dietitian is required to ensure the patient receives adequate nutrition.

Continuous cooperation between multidisciplinary teams involving DFSD staff, doctors, nurses and HAs is important to sustain all the remedial action. Regular training and continuous education also play a big role, especially for the new members to ensure they practice the remedial action. This study can be applied to the whole ward in HPSF and further to all hospitals.

Acknowledgements

The authors would like to thank the Director-General of Health, Malaysia, for his approval to publish this work. We also wish to thank our head of department, Mrs Nik Mahani Binti Nik Mahmood, for her support in this study, our QA team project for their hard work to make this project successful and gratefulness to our QA facilitators for sharing and giving ideas as well as comments in the process of this study. Finally, to those who were involved in the study location, Ward 4, Ward 5, PROY and DFSD, HPSF Muar.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the conduct of this study.

Funding

The authors received no financial support for the conduct of this study.

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Appendix 1: Questionnaire adapted from Patients' Diet Satisfaction (KKP)

BAHAGIAN A: MAKLUMAT UMUM DAN DEMOGRAFI		
A1	*Tarikh Kajian Dijalankan*	/ /
A2	*Tarikh masuk wad*	/ /
A3	*Kali ke berapa masuk wad tahun ini*	
A4	*Nama Wad*	
A5	*Disiplin Klinikal*	
A6	*Kelas Wad*	*1 Kelas 1* *2 Kelas 2* *3 Kelas3*
A7	*Jantina*	*1 Lelaki* *2 Perempuan*
A8	*Umur (tahun)*	
A9	*Bangsa*	*1 Melayu* *2 Cina* *3 India* *4 Lain-lain*
A10	*Taraf Akademik*	*1 Tiada Pendidikan Formal* *2 Sekolah Rendah* *3 Sekolah Menengah* *4 Kolej/Universiti*
BAHAGIAN B : MAKLUMAT PENYAKIT DAN RAWATAN		
B1	*Diagnosis*	
B2	*Rawatan*	*1 Pembedahan* *2 Kemoterapi/Radioterapi* *3 Paliatif* *4 Lain-lain prosedur*
B3	*Keadaan semasa pesakit yang menganggu pengambilan makanan. (sekiranya ada)*	*1 Tiada selera makan* *2 Loya* *3 Muntah* *4 Cirit-birit* *5 Sembelit* *6 Sakit mulut/ulcer* *7 Sukar menelan* *8 Cepat kenyang*
B4	*Pesakit menerima* oral nutrition supplement (ONS)	*1 Ya* *2 Tidak*
	Jika Ya, *Bancuhan_____scoop + air= ____mls* *Kekerapan minum sehari: _____*	
B5	*1 2 3 4 5 6 7 8 9 10* *Skala kesakitan:*	
B6	*Pengambilan ONS oleh pesakit:* *Jenis produk susu:_____* *Bancuhan: _____scoop + air=_____mls* *Tambahan protein modular:_____* *Jumlah yang dihabiskan: _____mls, Kekerapan minum sehari:_____*	
B7	*Ketepatan diet mengikut preskripsi:*	*1 Ya* *2 Tidak*
B8	*Adakah pesakit makan makanan hospital yang dihidangkan*	*1 Ya* *2 Tidak*
	Jika tidak, nyatakan alasan: _____	
	*Jika **Ya, sila jawab Bahagian C***	

BAHAGIAN C: MAKLUMAT KEPUASAN DIET TINGGI PROTEIN

1 Sangat tidak memuaskan	2 Tidak memuaskan	3 Sederhana	4 Memuaskan	5 Sangat memuaskan

C1	Adakah anda berpuas hati dengan **kepelbagaian** makanan berprotein yang dihidang?	(1) (2) (3) (4) (5)	
C2	Adakah anda berpuas hati dengan **porsi (saiz)** makanan yang dihidang?	(1) (2) (3) (4) (5)	
C3	Adakah anda berpuas hati dengan **persembahan** (gaya/hiasan) makanan yang dihidang?	(1) (2) (3) (4) (5)	
C4	Adakah anda berpuas hati dengan **kesegaran** makanan yang dihidang?	(1) (2) (3) (4) (5)	
C5	Adakah anda berpuas hati dengan **aroma (bau makanan)**yang dihidangkan?	(1) (2) (3) (4) (5)	
C6	Adakah anda berpuas hati dengan **tekstur (kelembutan)** makanan yang dihidang?	(1) (2) (3) (4) (5)	
C7	Adakah anda berpuas hati dengan **rasa makanan** yang dihidang	(1) (2) (3) (4) (5)	
C8	Adakah anda berpuas hati dengan **waktu makanan** dihidangkan?	(1) (2) (3) (4) (5)	
C9	Adakah anda berpuas hati dengan **suhu makanan** yang dihidang?	(1) (2) (3) (4) (5)	
C10	Adakah anda berpuas hati dengan **kebersihan makanan** yang dihidang ?	(1) (2) (3) (4) (5)	
C11	Adakah anda berpuas hati dengan **kebersihan peralatan** hidangan ?	(1) (2) (3) (4) (5)	
C12	Adakah anda berpuas hati dengan **layanan anggota** yang menghidang makanan?	(1) (2) (3) (4) (5)	
C13	Adakah anda: **Alergi/Vegetarian**	1	Ya
		2	Tidak
C14	Adakah anda **maklum** pada anggota wad mengenai masalah ini?	1	Ya
		2	Tidak
C15	Adakah anda **tahu** jenis diet yang dibekalkan?	1	Ya
		2	Tidak
C16	Jika ya, nyatakan **kepentingan** diet ini: _____		
C17	Adakah anda mendapat hidangan makan tengahari atau malam dari luar? (Contoh: bekalan makanan dari rumah atau makanan yang dibeli)	1	Ya
		2	Tidak

DIISI OLEH PIHAK JDS

Data dikumpul oleh: Tandatangan:……... Nama :……... Jawatan :……... Tarikh : ……...	Disahkan oleh: Tandatangan:…… Nama:…….. Jawatan:…….. Tarikh:……

Appendix 2: Standard Recipe Compliance Audit Form

AUDIT PEMATUHAN RESIPI PIAWAI
JABATAN DIETETIK DAN SAJIAN
RESIPI PIAWAI HOSPITAL KKM

NAMA PRODUK :
KAEDAH MEMASAK : PANGGANG / REBUS / GORENG
TITIK KAWALAN KRITIKAL : KAWALAN SUHU TENGAH PRODUK (>70°C) NYATAKAN:.....

TEMPOH MEMASAK : NYATAKAN :..... MULA:.....TAMAT:.....
PENGGUNA : K1 / K3 / SD / HPD / TERAPUTIK
WAKTU HIDANGAN : SARAPAN / MAKAN TENGAHARI / MINUM PETANG / MAKAN MALAM
PORSI HIDANGAN : 100 LAIN-LAIN:.....

SIFAT-SIFAT PRODUK :

KRITERIA	TANDAKAN (/)
LEMBAB DAN BERKUAH	
LEMBAB TIDAK BERKUAH	
TIDAK BERKUAH/KERING	
WARNA (NYATAKAN)	

BIL	BAHAN	KUANTITI MASAK(GM)	KUANTITI PIAWAI	NILAI ITEM (RM)	NILAI ITEM SEBENAR (RM)	PEMATUHAN (√ / X)	UJIRASA & KOMEN PENAMBAHBAIKAN	
1							PEGAWAI UJIRASA 1 : (COP)	
2								
3								
4								
5								
6								
7								
8								
9							PEGAWAI UJIRASA 2: (COP)	
10								
11								
12								
13								
14								
15								
16								
17								
18								

BIL	KAEDAH PENYEDIAAN
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

KANDUNGAN NUTRISI HIDANGAN:	KARBOHIDRAT (GM)	PROTEIN (GM)	KALORI (KCAL)	SODIUM (mg)

DISEMAK: .....

KOS PER MENU:	RM.....	
HASIL PRODUK AKHIR	KUANTITI (KETUL)	LEBIHAN (JIKA ADA)

DISAHKAN

Appendix 3: High-protein Diet Post Remedial Cycle 1 & 2

	Post-Remedial Cycle 1		Post-Remedial Cycle 2	
Meal Time	Menu	Protein content	Menu	Protein content
Breakfast	Fried Meehoon Tea	6 g (LBV)	Fried Meehoon Shredded chicken Low fat milk	6 g (LBV) 7 g (HBV) 7g (HBV)
Lunch	1 small bowl of rice (150g) 1 piece of Chicken Tomyam 1 piece of Stir-Fried Tofu Stir Fried Cabbage	6 g (LBV) 14g (HBV) 7 g (HBV)	1 small bowl of rice (150g) 1 piece of Chicken Tomyam Stir Fried Cabbage	6 g (LBV) 14g (HBV)
Afternoon Tea	2 slices of bread Tea	4 g (LBV)	2 slices of bread Scramble egg Low fat milk	4 g (LBV) 7 g (HBV) 7 g (HBV)
Dinner	1 small bowl of rice (150g) 1 piece of *Asam Pedas* Fish 1 nos of hardboiled egg Stir Fried Cabbage 1 piece of watermelon	6 g (LBV) 14g (HBV) 7g (HBV)	1 small bowl of rice (150g) 1 piece of *Asam Pedas* Fish Stir Fried Cabbage 1 piece of watermelon	6 g (LBV) 14 g (HBV)
Total Protein Served		64 g	Total Protein Served	78g