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Estimating Dietary Energy and Protein Requirements for Patients with Peripheral Arterial Disease: An Evaluation of Current Practice Amongst Dietitians

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Abstract

Aims: To (i) identify current practice of dietitians in determining energy and protein requirements for patients with Peripheral Arterial Disease (PAD); and (ii) explore the magnitude and implications of the variability in estimates with reference to typical patients at each stage of PAD.

Methods: An invitation to complete an online 26-item questionnaire was distributed electronically by the Dietitians Association of Australia to all members. Each method used by participants for estimation of energy and protein requirements across the stages of PAD was applied to the relevant typical patient and the range of estimates reported.

Results: Twenty-two dietitians completed the questionnaire and reported caseloads inclusive of all stages of PAD and with relatively equal frequency. For estimation of energy requirements, the Schofield equations in addition to 120-125kJ/kg and 125-145kJ/kg were most frequently used. When applied to the typical patient, the estimates of requirements varied by over 5000kJ/day within each stage of PAD. For estimation of protein requirements it was common to apply the RDI (0.8-1g/kg/day) or account for minor surgery or sepsis (up to 1.5g/kg/day) for patients with rest pain or tissue loss. The estimates of protein requirements varied by up to 55g/day depending on the method used.

Conclusions: There was significant variation in energy and protein estimates both within and across the stages of PAD, which is possibly due to the little evidence available to inform dietitians on how to best treat patients with PAD. Further work is required to acquire a solid evidence base and subsequently communicate this for translation into practice.

Keywords: Energy requirements; Protein requirements; Peripheral arterial disease; Diet; Dietetic practice

Introduction

The role of nutrition in Peripheral Arterial Disease (PAD) is recognised in the management of risk factors of PAD development and progression with specific dietary and nutrient recommendations available for hypertension, dyslipidaemia, and diabetes [1-7]. Nutritional health is important for wound healing [8]. Evidence has shown that both obesity, a known risk factor for PAD, and underweight/under-nutrition, a risk factor for poor wound healing, are prevalent in PAD patients [9,10]. Those providing care for adults with PAD rely on dietitians to make an accurate determination of dietary energy and protein requirements and prescribe medical nutrition therapy accordingly, however there are currently no specific guidelines for estimating energy and protein requirements in PAD. Dietary energy prescriptions in excess of requirements can have a number of negative effects on clients, including increased likelihood of overweight [11] while excess protein can adversely affect bone and kidney function [12]. Underestimation of energy and protein requirements can lead to diminished wound healing capacity and poorer immune function [8]. In the absence of evidence-based recommendations, the aims of this study were to (i) identify current practice of dietitians in determining energy and protein requirements for patients with PAD; and (ii) explore the magnitude and implications of the variability in estimates with reference to typical patients at each of the established stages of PAD: asymptomatic, claudication, ischemic rest pain and tissue loss.

Methods

An invitation to complete an online, 26-item questionnaire created using Survey Monkey (Zoomerang Pro 2013) was administered to financial members of the Dietitians Association of Australia (DAA), the national professional association for dietitians in Australia via a weekly email newsletter in February 2013. The Dillman Protocol [13] was followed to maximise response rate. Approval for this study was obtained from the Flinders University Social and Behavioural Research Ethics Committee (Approval number 5871). The questionnaire contained items regarding demographic characteristics of participants including

clinical experience in the area of medical nutrition therapy for patients with PAD and whether the participant routinely treated patients with PAD with those answering 'no' directed to the end of the questionnaire and thanked for their participation. The remainder of the questionnaire comprised of 15 items designed to gain an insight into the dietetic practice of estimating energy and protein requirements for each clinical stage of PAD as defined by Rutherford and colleagues, [14] outlined in Table 1.

On receipt of the completed questionnaires the predictive equations for estimating energy and protein requirements that were most commonly reported by participants were applied to a 'typical patient' to gain an insight into the range and potential overlap of estimations by stage of PAD. Data for the typical asymptomatic PAD patient (ICD I70.20, n=622), claudicant (ICD I70.21, n=384), patient with ischemic rest pain (ICD I70.22, n=86) and tissue loss (ICD I70.23, n=234) were obtained from the 45 and Up Study, the largest ongoing study of healthy ageing in the Southern Hemisphere and coordinated by the Sax Institute, New South Wales Australia [15]. The 'typical patient' for each stage of PAD based on the 45 and Up Study data was then used in all estimations of requirements in this study. Based on the information obtained regarding methods for energy and protein estimation, the authors developed a set of definitions based on evidence-based guidlines [16] for parameters used in estimation of energy and protein requirements. These are outlined in Table 2.

All de-identified data were imported from Survey Monkey into SPSS, version 19.0 (SPSS Inc, Chicago, IL, USA). Responses were displayed through the use of descriptive statistics to highlight trends. Continuous data were presented either as mean with 95% confidence intervals or median with Inter Quartile Range (IQR) depending on the distribution of the data. All categorical data were displayed as frequency and percentages of participants with each response.

Results

Of 4918 eligible persons, 45 dietitians responded to the online questionnaire. Of these, 23 (51%) did not routinely see PAD patients within their dietetic practice and therefore were not permitted to complete caseload and practice-based questions, providing a final sample size of 22 for the purpose of subsequent analyses. The methods of estimating energy and protein requirements used by participants according to each stage of PAD are shown in Table 3 and Table 4 respectively. The reasons provided for the selection of particular methods of estimating energy and protein requirements varied and included: training, clinical experience and evidence. Individual participants did not report altering the method used for estimation of energy requirements according to stage of PAD, however 10 (46%) participants reported that they would alter the method used for estimating protein requirements according to stage of PAD with requirements increasing as PAD progressed. Tables 3 and 4 illustrate that application of the methods used by participants for estimating energy and protein requirements resulted in very little variation across the stages of PAD. The only variation occurred if a dietitian were to apply an adjustment factor to account for sepsis, in patients with rest pain or tissue loss, when estimating protein requirements. In contrast, within each stage of PAD, participants did report a variety of methods for calculating estimated energy and protein requirements resulting in a range of estimated energy requirements that varied by more than 5000kJ/day and a variation of up to 55g/day for protein requirements within each PAD stage.

Discussion

This small cross-sectional study found that in the absence of specific, evidence-based recommendations, respondents used a variety of methods when estimating either dietary energy or protein requirements for patients with PAD and the variability in estimates when applied to a typical patient, would be of sufficient magnitude to have a clinically meaningful impact on patient outcomes. Furthermore, this study found that adjustment for stage of PAD when estimating dietary energy requirements was uncommon.

The findings of the present study would indicate that evidence-based recommendations to guide dietitians when estimating the energy and protein requirements of patients with PAD would be worthwhile to improve consistency in approach. The study showed that dietitians in Australia recognise that there are additional dietary energy needs during times of wound healing however when these adjustments were applied to a typical patient it resulted in only 1,000kJ extra. It might be argued that dietitians would review this estimation by monitoring body weight over time, and in the case of chronic arterial ulcers, this would be considered a valid argument. It is not however a valid

Table 1: Rutherford classifications for clinical stages of peripheral arterial disease and mean age and weight of typical patients at each of the stages.

	Rutherford classification	Mean age (yrs) of typical patient∞	Mean weight (kg) of typical patient∞
Stage 0	Asymptomatic	73.9(M) 74.6(F)	81.6(M) 67.2(F)
Stage 1	Mild claudication		
Stage 2	Moderate claudication		
Stage 3	Severe claudication	73.0(M) 74.2(F) †	81.7(M) 66.4(F) †
Stage 4	Ischemic pain at rest	75.2(M) 77.1(F)	79.4(M) 63.3(F)
Stage 5	Ischemic ulceration not exceeding ulcer of the digits of the foot		
Stage 6	Severe ischemic ulcers or gangrene	78.8(M) 81.8(F) ‡	79.7(M) 64.7(F) ‡

†Data represents mean age and weight of stage 1-3, ‡ Data represents mean age and weight of stages 5-6, ∞Data for a typical patient obtained from the 45 and Up Study[15]

Table 2: Author definitions of parameters utilized by Australian dietitians in the estimation of energy and protein requirements in PAD.

Parameter reported by survey participants	Definition utilized by authors
Actual Body Weight (ABW)	Current body weight on presentation
Ideal Body Weight (IBW)	Body weight representative of Body Mass Index 22.5kg.m^2
Adjusted ideal body weight (AiBW)	Weight at the mid-point between ABW and IBW
Weight loss factor (WLF)	Deficit of 2143kJ/day from the estimated energy requirements to induce 0.5kg weight loss/week.

Table 3: Estimated Energy Requirements of a typical patient across the stages of PAD utilising the methods reported by Dietitians in Australia.

	Asymptomatic		Claudication		Rest pain		Tissue Loss	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
EER (Schofield x 1.2)	7747	6369	7757	6332	7617	6192	7638	6257
EER (Schofield x 1.2, WLF 0.5kg)	5604	4226	5614	4189	5474	4049	5495	4114
Non-ambulatory or sedentary, not hypermetabolic (100-120kj/kg)	8158-9790	6719 - 8063	8174-9809	6637-7964	7936-9523	6330-7596	7972-9566	6472-7766
Slightly hypermetabolic, post-operative, repletion, infection(120-145kj/kg)	-	-	9809-11853	7964-9624	9523-11507	7596-9179	9566-11559	7766-9384
Hypermetabolic, severely stressed, malabsorption, major trauma, sepsis (145-160kj/ kg)	-	-	-	-	-	-	11559-12755	9384-10355
120-125kj/kg	9790-10198	8063-8399	9809-10218	7964-8296	9523-9920	7596-7913	9566-9965	7766-8090
125-145kj/kg	10198-11829	8399-9743	10218-11853	8296-9624	9920-11507	7913-9179	9965-11559	8090-9384

WLF – Weight loss factor of 2143kJ/day

Table 4: Estimated protein requirements of a typical patient across the stages of PAD utilising the methods reported by Dietitians in Australia.

Method of estimation	**Asymptomatic**		**Claudication**		**Rest pain**		**Tissue Loss**	
	Male	Female	Male	Female	Male	Female	Male	Female
EPR (RDI 0.8g/kg)	65.2	53.8	65.4	53.1	63.5	50.6	63.8	51.8
EPR (RDI 0.85g/kg)	69.3	57.1	69.5	56.4	-	-	-	-
EPR (RDI 1g/kg)	81.5	67.2	81.7	66.4	79.4	63.3	79.7	64.7
Minor Surgery (1g/kg)	81.5	67.2	81.7	66.4	79.4	63.3	79.7	64.7
Minor Surgery (1.2g/kg)	97.8	80.6	98.1	79.6	95.2	76.0	95.7	77.7
Sepsis (1.2-/kg)	-	-	-	-	95.2	76.0	95.7	77.7
Sepsis (-1.5g/kg)	-	-	-	-	119.0	95.0	119.6	97.1

argument to suggest that there are no differences in dietary energy requirements between the other three stages of PAD [17,18] and that monitoring would allow for adjustments as asymptomatic patients and those with claudication or rest pain would rarely be seen regularly enough to detect clinically meaningful changes in body weight. The magnitude of the variability in estimates observed in this study could translate to a concerning potential weight gain or loss of more than 1kg/week in males and 0.5-1kg/week in females.

Unlike estimates of energy requirements, some dietitians in this study did report that they were likely to adjust dietary protein requirements with stage of PAD. Despite this, when the adjustment factors reported were applied to the typical patient, the dietary protein requirements for those with sepsis, rest pain or tissue loss were similar to estimates for asymptomatic PAD patients and those with claudication. Conventional management of these patients is supervised exercise training and emerging evidence suggests that repeated exposure to ischemic reperfusion injury initiates muscle atrophy, specifically in the symptomatic leg [19]. Accurate dietary protein estimates and prescription is likely critical in the prevention of this adverse outcome.

It is important to declare that this study is not devoid of limitations and hence interpretation of the findings should be considered with caution. The small sample of dietitians (n=22) who responded to the questionnaire is one important limitation that may impact on the generalisability of the findings. The widely accepted Dillman Protocol for Web-Based Surveys [13] was used with the intention to maximise response rates through the use of reminder emails and simple questionnaire design. The sample included dietitians Australia-wide and it is interesting

to note that their characteristics were not dissimilar to those of the DAA member population according to the 2011 DAA Annual Report [20]. Some of the assumptions made in the calculations of requirements for the typical patients may not be truly reflective of the intentions of those completing the questionnaire. We multiplied BMR by an activity factor of 1.2 across all stages of PAD for our estimations of energy requirements however it could be argued that a higher activity factor would be more applicable for asymptomatic patients. Notwithstanding the validity of this argument, the net result of a higher activity factor would be minimal (~500kJ for an increase to 1.3) and it would not affect our findings relating to the large variation in estimating requirements of both energy and protein within each stage of PAD.

The accurate determination of dietary energy and protein requirements for PAD patients should be a priority area of research. The rate of growth in the aging population of western countries, in conjunction with a rise in Type 2 diabetes mellitus and overweight/obesity will see the number of PAD patients increase within the next decade and beyond. There was significant variation in energy and protein estimates within this study which is possibly due to the little evidence available to inform dietitians on how to best treat this patient group. Therefore, the creation of new evidence from well designed studies with larger sample sizes investigating the energy and protein requirements, and the development and communication of evidence-based guidelines on how to adequately provide nutritional care to PAD patients is an urgent area for further research. In the interim, dietitians should use available equations for estimating requirements with caution and closely monitor the nutritional intake and nutritional status of this patient group allowing adjustment of estimates over time.

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