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Current Practices of Irish Dietitians Assessing and Monitoring Muscle Strength, Mass and Function: A Cross-Sectional Survey

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ABSTRACT

Background and Aims: Measuring muscle mass, strength, and function is vital in nutritional assessment, offering valuable insights into overall health, including nutritional adequacy, metabolic function and physical well-being. Nonetheless, the use of these measures for nutritional assessment and monitoring in dietetic practice is not widely implemented, and gaps in care remain. This study aimed to explore Irish dietitians' current nutritional assessment practices related to muscle health.

Methods: A cross-sectional descriptive 29-item online survey was adapted and distributed via link in email and social media to state-registered dietitians ($N = 1340$) in Ireland between 21 September 2023 and 26 October 2023. Data were analysed descriptively.

Results: The majority of dietitians (84/85) agreed that musculature was important in the assessment of nutritional status, with 80% ($n = 56/70$) reporting the integration of at least one assessment of muscle health into their clinical practice. Handgrip strength (HGS) was viewed as the most important (95.7%; $n = 67/70$), frequently applied (64.3%; $n = 45/70$) and most useful for monitoring muscle health (77.1%; $n = 54/70$). Regardless, the frequency of muscle health assessment in routine practice was low. The muscle health assessments that are routinely (> once/week) measured include body weight (82.9%; $n = 58/70$), BMI (81.4%; $n = 57/70$), HGS (25.7%; $n = 18/70$) and the Timed up and go test, chair stand test or short physical performance battery (10%; $n = 7/70$). The main barriers to muscle health assessment were 'lack of training/application experience' (61.4%, $n = 43/70$) and 'lack of device availability' (58.5%, $n = 41/70$).

Conclusion: This study provides insights into the application of muscle health assessments within nutritional assessment among Irish dietitians. Results indicate a gap between the recognised value of muscle health and its use in nutritional assessment. Despite an almost unanimous agreement on the importance of musculature, challenges such as insufficient training and lack of equipment hinder the widespread implementation of muscle health assessment as a standard component of nutritional assessment. These findings emphasise the need for further practical education and measures to improve the availability of equipment to bridge this gap and optimise nutritional care.

Summary

- Most dietitians agree that muscle health is crucial for assessing nutritional status, with handgrip strength being the most valued tool.
- Despite recognising the importance, muscle health assessments are not frequently performed due to a lack of training and equipment.
- There is a need for practical education and increased availability of equipment to improve the application of muscle health assessments in clinical practice.

1 | Introduction

Muscle health, specifically muscle mass, is a defining feature of clinical conditions, including malnutrition, sarcopenia and frailty, which often overlap and negatively affect health-related outcomes [1–4]. Malnutrition due to starvation, disease or ageing can be defined as 'a state resulting from lack of uptake or intake of nutrition leading to altered body composition (decreased fat-free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease' [5, 6]. Malnutrition-related muscle mass loss is associated with diminished physical function, increased rates of infections and illnesses and longer recovery times [3, 7–11]. Loss of muscle mass is of particular concern among the ageing population, where physical decline has negative implications for activities of daily living and quality of life [12].

Sarcopenia, characterised by low muscle mass and muscle strength, can develop progressively as harmful alterations occur in the muscle over the course of a lifetime, affecting an estimated 6%–19% of the general population ≥ 60 years [13–15]. Malnutrition and sarcopenia share low muscle mass as a key diagnostic criterion and often co-exist [16, 17]. Frailty can also present with similar phenotypic characteristics to malnutrition and sarcopenia [18]. Frailty often affects muscle health and is defined as a medical syndrome with various causes and factors, characterised by reduced strength, endurance and physiological function, heightening an individual's risk of increased dependency and mortality [19].

Malnutrition, sarcopenia and frailty are common among hospitalised older adults, with about half of those admitted experiencing two or three of these conditions [8, 10, 11, 20]. In the community setting, nearly one in five individuals > 50 years are affected [21]. Beyond the debilitating effects, these conditions are associated with increased healthcare costs [1, 20, 22, 23]. As life expectancy increases, those aged ≥ 65 years are at greater risk for conditions such as malnutrition, frailty and sarcopenia [20, 21, 24]. Assessing muscle health to identify these conditions is critical [2, 5, 7, 13] and should be a key component of nutrition assessments.

The Global Leadership Initiative on Malnutrition (GLIM) recognises low muscle mass as a criterion for diagnosing and grading the severity of malnutrition [25, 26]. For frailty, physical function and strength are components of common assessment tools [27]. When diagnosing sarcopenia, low muscle strength is the primary criterion, and assessment of muscle mass and muscle function is required to determine severity [13]. In Ireland, a preliminary study found that 61.3% (19/31) of community-dwelling older adults receiving home care had probable sarcopenia based on handgrip strength (HGS) alone [9]. However, a subsequent study of 308 community-dwelling older adults reported prevalence of probable sarcopenia (low HGS and normal skeletal muscle mass) as 20.8% (64/308), confirmed sarcopenia (low HGS and low skeletal muscle mass) as 8.1% (25/308) and severe sarcopenia (low HGS, low muscle mass and low physical performance) as 5.8% (18/308) [13, 28].

Given the risk of malnutrition, sarcopenia and frailty and associated increased healthcare expenditures, early detection through incorporation of muscle health assessment is vital [3, 29]. Specific to dietetic practice, muscle health assessment should be incorporated as part of the Nutrition-Focused Physical Examination (NFPE) to increase the appropriateness and effectiveness of nutrition care plans [30]. NFPE is a simple and quick clinical examination using a head-to-toe approach to evaluate muscle mass, fat stores, fluid retention, micronutrient deficiencies and functional capacity [31]. It incorporates mid-upper arm circumference (MUAC) and/or calf circumference (CC) to assess muscle mass and HGS and/or Chair Stand test to assess muscle strength. In Ireland, when dietitians attended an NFPE examination workshop, the number of dietitians who reported performing NFPE increased from 4 before the workshop to all 22 participants after the workshop [32]. A Swiss study by Uhlmann et al. found that dietitians ($n = 117$) do not routinely assess muscle health [33]. Barriers to widespread assessment included insufficient knowledge, experience and inadequate access to the equipment required [33]. The authors concluded that professional development, practical training and education could support further integration of muscle health assessment into practice [33]. A small hospital-based survey of practices, competency and attitudes of Australian dietitians ($n = 22$) reported individual, team and organisational barriers to adopting muscle health assessment in clinical practice [34]. To the best of our knowledge, while other research has examined the impact of nutrition counselling on muscle health or the use of malnutrition screening tools, little is known about the application of muscle health assessment by dietitians.

Given the prevalence and negative implications of conditions associated with poor muscle health, this study aimed to understand Irish dietitians' clinical practices of muscle mass, strength and function measures as part of nutrition assessment.

2 | Materials and Methods

2.1 | Study Design

A cross-sectional, descriptive study was conducted to elucidate the assessment and monitoring of muscle mass, strength and function during nutritional evaluations by state-registered dietitians in Ireland. The study was approved by the University of Limerick Education & Health Sciences Faculty Research Ethics Committee [2023-06-16(ER)]. All participants provided informed consent.

2.2 | Online Survey

Data were collected using an adapted version of a 29-item online survey originally developed by Uhlmann et al. (2022). The survey consisted of seven sections: (1) participant consent (1 question); (2) confirmation of dietetic registration in the Republic of Ireland (1 question); (3) perception of the importance of muscle health assessment, knowledge of muscle health and views on conducting and interpreting these assessments (9 questions); (4) current use of measures of muscle health within nutritional assessment (9 questions); (5) facilitators and barriers to the application of muscle health assessment in practice (2 questions); (6) professional focus, years of experience and knowledge acquisition (8 questions) and (7) an open textbox to provide additional information.

The survey included multiple-choice questions, some of which allowed for multiple answers, and 5-point Likert scale questions. Other questions included matrix responses and relevancy rated on a scale from 0% (not at all relevant) to 100% (highly relevant). One open text field question was included in Section 4 to gain a better understanding of how dietitians use measurement(s) of muscle mass in their nutritional assessments.

Table 1 lists common measures that were addressed in the survey that allows assessment of muscle mass, strength and function. These measures were chosen based on their use in the original survey [33], their inclusion in the diagnostic criteria for sarcopenia [13] and their common application in clinical practice [25, 35, 36]. In addition, BMI and body weight measurement were included as responses throughout the survey to allow for a comparison to known established physical assessments completed by dietitians routinely [33, 37].

The survey was adapted for use within an Irish healthcare context with further adaptations based on the responses of a pilot survey (Supporting Information File 1). This included rephrasing 'muscle parameters' as 'muscle health'. In the adapted survey, upper arm and calf circumferences were measured separately, as calf measurements are more sensitive to age-related muscle mass loss [38]. Finally, the adapted survey added a question about participants' familiarity with calf circumference cut-off values for muscle mass, BIA output components (e.g., phase angle, body weight and fat-free mass) [39] and how dietitians use muscle mass assessment in nutritional evaluations.

TABLE 1 | Assessment of muscle health.

Muscle mass
Bioelectrical impedance analysis (BIA)
Magnetic resonance imaging (MRI)
Computed tomography (CT)
Dual-energy X-ray absorptiometry (DXA)
Calf circumference (CC)
Mid-upper arm circumference (MUAC)
Muscle strength
Handgrip strength (HGS)
Chair stand test
Muscle function
Timed up and go (TUG)
Short physical performance battery (SPPB)
400 m walking test

Pilot testing was completed by four dietitians who had experience in the nutrition care of older adults and research related to muscle health assessment. Subsequent adaptations included listing areas of professional focus in Ireland ('acute medicine', 'diabetes', 'disability', 'acute hospital', 'social care' and 'mental health') and hospital types relevant to the Irish health system ('public hospital', 'voluntary public hospital', 'private hospital' and 'private clinic'). The term 'during a study programme' was changed to 'during dietetic undergraduate/master's degree' to reflect the education system.

Qualtrics software (https://www.qualtrics.com; Provo, Utah, the United States) was used for survey distribution and data collection [40]. The survey was designed with built-in logic to change dynamically based on respondent's answers, meaning that certain questions were skipped or added depending on previous responses. This made the survey more relevant and streamlined for each participant. Responses were returned anonymously.

2.3 | Participants and Distribution of Online Survey

The inclusion criteria were state-registered dietitians employed in acute hospitals, social care, mental health, primary care, health and well-being, private practice, residential care, community and other services, such as community delivery and support of nutrition care in Ireland. At the time of survey distribution, there were 1340 state-registered dietitians [41]. The online survey was distributed between 21 September 2023 and 26 October 2023 via the professional body, the Irish Nutrition and Dietetic Institute (INDI), via e-zine, whose membership represents approximately 55% of registered dietitians. An e-invitation with a link to the survey and consent information was sent to all members. A call to action to partake in the study was issued from the investigators' social media accounts to try to capture those who are not INDI members. A reminder to participate was issued on 5 October 2023.

2.4 | Data Analysis

Survey results were downloaded from Qualtrics [40] in September 2023. Completed surveys were included in the analysis. Data were analysed descriptively using SPSS version 27 (IBM Corp, Armonk, New York, the United States) and Microsoft Excel version 2308 (Microsoft Corporation, Redmond, Washington, the United States). Responses to Likert scale questions ranking the importance of individual measures of muscle health were consolidated. For example, the responses 'rather important' and 'very important' were combined into a single category to enhance the clarity and interpretability of the analysis.

TABLE 2 | Demographic profile of participants ($n = 85$).

Profile	*N*	%
Education achievement		
Bachelor of Science	35	41.2
Masters level	29	34.1
PhD	2	2.4
Missing responses	19	22.4
Work setting		
Acute hospital	37	43.5
Primary care	9	10.6
Community	8	9.4
Other	8	9.4
Residential care	2	2.4
Social care	1	1.2
Health and well-being	1	1.2
Missing response	19	22.4
Professional focus[a]		
Older people	35	41.2
Acute medicine	22	25.9
Other areas[b]	15	17.6
Diabetes	10	11.8
Gastroenterology and hepatology	10	11.8
Obesity	8	9.4
Surgery	8	9.4
Palliative care	7	8.2
Respiratory	5	5.9
Orthopaedics	4	4.7
Emergency medicine	3	3.5
Rehabilitation	3	3.5
Cardiovascular/stroke	3	3.5
Disability	2	2.4
Mental health	2	2.4
Neurology	2	2.4
Paediatrics and/or neonatology	2	2.4
Renal	1	1.2

[a]Participants could choose more than one professional focus area of clinical practice.
[b]Other areas include critical care units ($n = 3$), eating disorders ($n = 1$), home enteral nutrition ($n = 1$) and oncology/haematology ($n = 3$), covering more than one clinical area ($n = 4$).

2.5 | Results

One hundred participants started the survey. Nine participants were excluded from the analysis as they did not consent ($n = 1$) or did not confirm that they were dietitians registered to practice in Ireland ($n = 8$). A further six participants did not proceed with the survey after consenting. The demographic profile of participants is shown in Table 2. All participants were registered dietitians, each holding at least a Bachelor of Science degree. On average, they reported 30.4 years of professional experience (median: 31 years; IQR: 14 years; Quartile 1: 23 years; Quartile 3: 37 years). Nine participants had 3 years or less professional experience. Most participants worked in acute hospital settings, with smaller numbers in primary and community settings. Other work environments included integrated care, rehabilitation, academia and private practice. The majority of participants' clinical practice focused on older person care, followed by acute medicine.

2.6 | Dietitians' Perceptions of Muscle Health Assessment

All participants, except for one (84/85), agreed with the statement 'musculature is important in the measurement of nutritional status'. Fifteen participants did not proceed with the survey after this statement. Therefore, 70 surveys were included in the remaining analysis. For questions that did not receive responses from all participants, the exact number of respondents (n) is reported.

Participants were asked to rate the relevance of muscle health to nutritional care on a scale from 0% (not relevant) to 100% (highly relevant). Thirty-eight participants (54.3%, $n = 38/70$) rated the relevance of muscle health to nutritional care as highly relevant (at 100% on the scale). Overall, the ratings ranged from 16% to 100%, with the majority (69/70) rating the importance at 64% or higher.

Slightly more participants perceived muscle mass as having a greater significance on nutritional care over strength and function (37.1% [$n = 26/70$], 34.3% [$n = 24/70$] and 28.6% [$n = 20/70$]), respectively. Of the common forms of muscle health assessment listed in Table 1, participants rated HGS (95.7%, $n = 67/70$), followed by the TUG (90%, $n = 63/70$) and then the 400 m walking test (84.3%, $n = 59/70$) in terms of importance for the measurement of nutrition status. BMI was rated as the least important measure of muscle health (25.7%; $n = 18/70$).

Statements about the value of using muscle parameters in practice that received the highest agreement from participants were: 'increases the added value of nutritional care' (98.5%, $n = 69/70$), 'adds new scientific evidence to daily clinical practice' (95.7%, $n = 67/70$), 'provides objective data' (95.7%, $n = 67/70$) and 'has a positive effect on interprofessional collaboration' (90%, $n = 63/70$). Most participants reported having good knowledge of body weight (90%, $n = 63/70$), BMI (89.9%, $n = 62/69$), HGS (80%, $n = 56/70$) and upper arm circumference (68.6%, $n = 48/70$). More than half of the participants reported poor knowledge of measurements taken by DXA, MRI and CT (51.4%, $n = 36/70$) and not being familiar with calf circumference cut-offs as a marker of muscle mass (52.9%, $n = 37/70$).

2.7 | Dietitians' Attitudes About Performing Assessments of Muscle Health

Table 3 presents participants' opinions on which healthcare professionals should routinely measure and interpret, as well as those who currently measure, various muscle health parameters

within their practice settings. Overall, participants perceived dietitians as the primary healthcare professionals for assessing and interpreting most muscle health parameters, especially those related to body composition and simpler measurements. Medical doctors were viewed as primarily involved in advanced imaging techniques of muscle health (MRI, DXA or CT). There were some notable discrepancies between the perceived roles and actual practices of different healthcare professionals in the participants' healthcare work setting. Physiotherapists were viewed as key in assessing and interpreting functional tests (TUG, Chair Stand Test, SSPB and walking test), strength tests (HGS) and measurements of mass (MUAC and CC) as parameters of muscle health. However, the percentage of physiotherapists perceived as currently measuring these parameters was lower.

2.8 | Dietitians' Application of Muscle Health Assessment in Practice

Eighty percent ($n = 56/70$) reported integrating at least one measurement of muscle health as part of nutritional assessment. Among these, HGS was the most frequently used measurement (64.3%, $n = 45/70$; Table 4). The 'other' measurements listed included performing an NFPE ($n = 5$). Of these, four participants worked in acute hospital settings and one worked in a community setting, who reported being trained but rarely using NFPE. Measures of body composition were also listed as 'other', including MUAC ($n = 8$) and CC ($n = 5$). Approximately half of the dietitians (60%, $n = 42/70$) report assessing muscle health in the follow-up of nutrition care with patients. Among these, HGS was reported as the most useful in monitoring (77.1%, $n = 54/70$; Table 4).

Thirty-eight (54.2%) participants described how they used measures of muscle health as part of their nutrition assessment. Common themes included comparison with reference ranges ($n = 21$) or baseline/previous patient assessment ($n = 13$); use of HGS to monitor for sarcopenia/malnutrition ($n = 5$), with a further three participants who referenced the European Working Group on Sarcopenia in Older People screen (EWGSOP2); and general statements related to monitoring for malnutrition/sarcopenia ($n = 4$). Ten participants (14.2%) reported integrating bioelectrical impedance analysis (BIA) into their nutritional assessment. When asked what components of BIA were utilised, 6 participants reported using PHA and TBW and 9 participants reported using FFM.

Dietitians reported routine application of simple body composition assessments like body weight and BMI, while more complex assessments of muscle mass like MUAC, CC, BIA and advanced imaging techniques are used less frequently (Table 5). HGS was an exception and was more frequently reported compared with other muscle health assessments, such as muscle function tests, which were rarely applied.

2.9 | Facilitators and Barriers of Muscle Health Assessment

From the suggested list of facilitators to enable muscle health assessment, 'Good knowledge/understanding of the measurements methods/parameters' (82.9%, $n = 58/70$) and 'Sufficient practical training/application experience' (81.4%, $n = 57/70$) were considered most relevant. 'Sufficient scientific evidence (e.g., available reference values/knowledge of the state of research)' was also frequently reported (71.4%, $n = 50/70$), followed by 'Device availability' (70%, $n = 49/70$).

Reported barriers to the application of muscle health assessment in practice included 'Lack of practical training/application experience' (61.4%, $n = 43/70$), 'Lack of device availability' (58.5%, $n = 41/70$), 'Insufficient time for application' (48.6%, $n = 34/70$) and 'Lack of knowledge/understanding of the methods/parameters' (45.7%, $n = 32/70$). Participants reported that they received education in muscle health assessment mostly through independent/self-directed scholarship (60%, $n = 42/70$), followed by attendance at webinars (54.3%, $n = 38/70$), peer support from dietetic colleagues (51.4%, $n = 36/70$) and attendance at conferences/workshops (40%, $n = 28/70$). When asked if there was an interest in acquiring more information and practical skills on the assessment of muscle health, 91.4% ($n = 64/70$) responded yes. Preferred means of learning included workshops (65.7%, $n = 46/70$), webinars (61.4%, $n = 43/70$) and focused further education (42.9%, $n = 30/70$).

3 | Discussion

Our findings indicate that while dietitians in Ireland recognise the value of assessing muscle health, this practice is not routinely applied due to a lack of practical training. Nonetheless, the significance of muscle health assessment was widely acknowledged by Irish dietitians, with perceived benefits including enhanced nutritional care, objective data for nutrition assessment, incorporation of new scientific evidence and improved interprofessional collaboration.

Dietitians participating in this study overwhelmingly agreed (84/85) with the statement that musculature is important in the measurement of nutritional status. A unanimous response was reported in the Swiss study [33]. While most Irish dietitians incorporated at least one muscle health assessment into their nutritional assessments, with HGS being the most common and useful for patient monitoring, its frequent application remains limited. Only about one in five dietitians assessed HGS routinely, indicating a gap between recognition of its value and application in practice. Other forms of muscle health assessment were more rarely applied in dietetic practice. Irish dietitians differed from their Swiss counterparts, who reported using BIA most frequently for nutrition assessment and monitoring. Additionally, Irish dietitians reported more frequent use of functional tests (10% vs. 3.4% TUG/Chair Stand Test/SPPB; 5.7% vs. 3.4% walking test, respectively). Nonetheless, our findings further emphasise the gap that was highlighted in the original Swiss study [33] between the perceived importance of muscle health for assessing nutritional status and the application of muscle health assessments into routine clinical practice.

The importance of muscle health cannot be understated. Conditions such as malnutrition, sarcopenia and frailty are associated with poor health prognosis and increased healthcare costs [2, 7–11, 19, 20, 22, 23]. As found in the Swiss study, Irish

TABLE 3 | Dietitians' opinion on which healthcare professionals (A) should assess, (B) should interpret and (C) currently measure muscle health according to the different measurement parameters available ($n = 70$).

Parameter	Healthcare professional % (n)[a]														
	Dietitians			Doctors			Nurses			Physiotherapists			Other therapists		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Body weight	90 (63)	97.1 (68)	88.5 (62)	67.1 (47)	62.3 (44)	37.1 (26)	87.1 (61)	58.6 (41)	75.7 (53)	51.4 (36)	35.7 (25)	12.9 (9)	32.9 (23)	18.6 (13)	12.9 (9)
BMI	94.3 (66)	97.1 (68)	92.9 (65)	57.1 (40)	60 (42)	28.6 (20)	80 (56)	54.3 (38)	57.1 (40)	37.1 (26)	31.4 (22)	4.3 (3)	25.7 (18)	14.3 (10)	4.3 (3)
Mid-upper arm circumference	95.7 (67)	92.9 (65)	74.3 (52)	10 (7)	22.9 (16)	—	40 (28)	24.3 (17)	10 (7)	41.4 (29)	41.4 (29)	4.3 (3)	12.9 (9)	7.1 (5)	1.4 (1)
Calf circumference	82.9 (58)	80 (56)	48.6 (34)	14.3 (10)	22.9 (16)	1.4 (1)	34.3 (24)	18.6 (13)	5.7 (4)	54.3 (38)	48.6 (34)	14.3 (10)	17.1 (12)	10 (7)	2.9 (2)
Body impedance analysis	84.3 (59)	82.9 (58)	28.6 (20)	35.7 (25)	47.1 (33)	8.6 (6)	15.7 (11)	10 (7)	1.4 (1)	25.7 (18)	32.9 (23)	—	14.3 (10)	10 (7)	4.3 (3)
Dual X-ray absorptiometry, magnetic resonance imaging or computed tomography	35.7 (25)	44.3 (31)	10 (7)	80 (56)	80 (56)	48.6 (34)	7.1 (5)	12.9 (9)	2.9 (2)	15.7 (11)	25.7 (18)	4.3 (3)	15.7 (11)	11.4 (8)	5.7 (4)
Handgrip strength	97.1 (68)	94.3 (66)	77.1 (54)	20 (14)	40 (28)	1.4 (1)	38.6 (27)	31.4 (22)	7.1 (5)	87.1 (61)	81.4 (57)	45.7 (32)	30 (21)	17.1 (12)	7.1 (5)
Timed up and go test, chair stand test or short physical performance battery	37.1 (26)	45.7 (32)	8.6 (6)	18.6 (13)	34.3 (24)	—	25.7 (18)	22.9 (16)	1.4 (1)	95.7 (67)	94.3 (66)	74.3 (52)	22.9 (16)	17.1 (12)	4.3 (3)
Walking test	32.9 (23)	41.4 (29)	2.9 (2)	18.6 (13)	32.9 (23)	—	24.3 (17)	21.4 (15)	—	92.9 (65)	92.9 (65)	72.9 (51)	18.6 (13)	15.7 (11)	2.9 (2)

[a]Participants could choose more than one healthcare professional in their response.

TABLE 4 | Muscle health assessment (a) integrated into nutrition assessment and (b) used for monitoring patients by dietitians ($n = 70$)[a].

Assessment of muscle health	Response frequency %, (*n*)	
	a. Integrated in nutrition assessment	**b.** Useful for patient monitoring
Bioelectrical impedance analysis	14.2 (10)	17.1 (12)
Magnetic resonance imaging, computed tomography, dual-energy X-ray absorptiometry	1.4 (1)	4.3 (3)
Handgrip strength	64.3 (45)	77.1 (54)
Timed up and go test, chair stand test or short physical performance battery	10 (7)	11.4 (8)
Walking test	2.9 (2)	4.3 (3)
Others	30 (21)	22.9 (16)

[a]Participants could choose more than one assessment of muscle health in their response.

TABLE 5 | Frequency % (*n*) of the application of muscle health assessment in practice by dietitians ($n = 70$).

	Rarely (< 10 times a year)	Frequently (> once per month)	Routinely (> once per week)
Body weight	5.7 (4)	5.7 (4)	82.9 (58)
BMI	2.9 (2)	8.5 (6)	81.4 (57)
Mid-upper arm circumference	68.5 (48)	15.7 (11)	7.1 (5)
Calf circumference	77.1 (54)	7.1 (5)	5.7 (4)
Bioelectrical impedance analysis	77.1 (54)	7.1 (5)	5.7 (4)
Dual-energy X-ray absorptiometry, magnetic resonance imaging, computed tomography	87.1 (61)	1.4 (1)	1.4 (1)
Handgrip strength	42.9 (30)	25.7 (18)	25.7 (18)
Timed up and go test, chair stand test or short physical performance battery	92.9 (65)	1.4 (1)	10 (7)
Walking test	81.4 (57)	2.9 (2)	5.7 (4)

dietitians routinely measured body weight and BMI more than once per week, likely due to the simplicity of these approaches and their inclusion in common malnutrition screening tools [33, 37, 42]. However, low muscle mass and malnutrition can be masked by normal or excessive body size [3, 37, 42] and may not be captured by body weight or BMI. Muscle health assessment is crucial for identifying risk for malnutrition, sarcopenia and frailty. Decreased muscle mass indicates malnutrition [25], with decreased muscle strength and function indicating frailty [43] and severity of sarcopenia [13]. Therefore, it is important that muscle health assessment is integrated into clinical care to identify the risk of these conditions, initiate early intervention and mitigate adverse health outcomes, including healthcare burden and costs [2, 4, 10, 23, 37, 42].

Among the common tools for muscle health assessment, HGS was rated as the most important by dietitians, followed by the TUG and the 400 m walking tests. These findings highlight the perceived value of these muscle assessment tools when evaluating nutrition status. Despite this, dietitians viewed these assessments as a physiotherapist's responsibility. In line with the Swiss study, findings revealed that most dietitians do not see functional assessments of muscle health within their scope of practice [33]. From the literature, it is known that physiotherapists generally express confidence and a positive attitude toward providing nutrition care, although they often feel less confident in their nutrition knowledge and skills [44]. Likewise, dietitians express confidence and a positive attitude in counselling about physical activity but express a need for enhanced knowledge and scope of practice [45, 46]. Addressing these gaps in practice could lead to a more integrated approach to muscle assessment, resulting in combined nutrition and exercise interventions and ultimately improved muscle health outcomes.

Dietitians viewed fostering interprofessional collaboration as a benefit of assessing muscle health. Interprofessional collaboration, particularly as a multimodal approach to nutrition and exercise assessment and intervention, may have the potential to improve muscle health [3]. Although this is not investigated in the current study, such an approach is further supported by the finding that, despite having distinct professional identities, both dietitians and physiotherapists advocate for interprofessional treatment [47]. Dietetics as a profession understands the value interprofessional collaboration has for patients, healthcare workers and healthcare providers alike [48]. Despite the strong willingness for interprofessional collaboration, actual involvement remains limited [47]. This may be due to factors such as

role clarity, resource constraints and the need for further professional development [47, 49].

Dietitians reported significant barriers related to muscle health assessment, including a lack of training and practical experience, limited access to necessary devices and insufficient time. Most dietitians participating in the current study worked in acute care settings. Indeed, much of the literature exploring the implementation of body composition assessment into routine practice focuses on acute settings. Inadequate training and time have previously been cited as barriers to performing NFPE among dietitians working in Ireland [32]. Similar barriers were highlighted in the original Swiss study [33], research from the United States [50] and Australia [34]. Despite device availability as a barrier to assessment, very few dietitians reported frequent use of muscle mass assessments that required minimal equipment (e.g., tape measure), including MUAC and CC [42]. A lack of standard procedures in departmental policies, that would likely support implementation of the measurements by addressing environmental contexts and resources, has also been identified [34]. Further research in various healthcare settings is necessary to gain a deeper understanding of the opportunities and challenges involved in integrating muscle assessment in routine practice.

Despite two-thirds of dietitians in the current study being knowledgeable about MUAC, nearly half lacked familiarity with CC cut-offs for age-related muscle loss, indicating a need for further education [7]. Research from the United States found that over 95% of registered dietitians who completed NFPE training ($n = 96$) reported conducting muscle examinations in their practice [51]. Almost all the dietitians who took part in our survey stated that they were interested in acquiring more information and developing practical skills for muscle health assessment. These findings highlight the need for more practical NFPE and muscle health assessment workshops. A greater availability of workshops aimed at providing dietitians with enhanced practical skills could improve the application of muscle health assessments in clinical practice [31].

While our study provides valuable insights into the current use of muscle assessment by dietitians in Ireland, it also highlights the need for a more comprehensive approach to embed this practice into routine care. Taking an implementation science approach in future studies would support routine muscle assessment in dietetic practice by systematically guiding evidence selection, adapting knowledge to local contexts, identifying barriers and enablers, selecting appropriate interventions and monitoring and sustaining outcomes [34, 46, 50]. Additionally, exploring interprofessional collaboration could further enhance the integration of muscle assessment into routine care by leveraging the diverse expertise and perspectives of various healthcare professionals.

4 | Strengths and Limitations

A limitation of this study was the relatively small sample size; 6.3% of registered dietitians in Ireland in 2023 [41] participated. Participants were primarily recruited through the professional body, which represents 55% of dietitians registered in Ireland. Although attempts were also made to recruit via social media, these methods proved to be inefficient. Additionally, representation from the community and primary care settings was lacking when compared to dietetic employment reports of 59.3% working in acute settings [52], 40.0% in the community [53] and 27.6% in primary care [54]. Notably, bias may have occurred whereby participants with a greater interest in muscle health assessment may have been more likely to participate. The use of predefined response options may have limited a deeper understanding of embedding the practice of muscle assessment into routine nutrition care. Lastly, the survey was adapted with permission from a Swiss context, for use in an Irish context. The survey has not been validated in either country. A major strength of this study is its novel role in providing new knowledge and insight into the perceptions and attitudes towards muscle health assessment in Ireland. Furthermore, it identifies key barriers faced by dietitians in this process.

5 | Conclusion

This survey is the first to provide detailed insights into the application of muscle health assessment among registered dietitians working in Ireland. Irish dietitians acknowledged the importance of muscle for nutrition status, yet rarely applied muscle health measurement as part of their nutrition assessment. Recognised benefits of muscle health assessment included identification of the risk of malnutrition, sarcopenia and frailty among patients who would benefit from earlier intervention. Barriers to muscle health assessment in dietetic practice were identified as a lack of training and practical experience. The provision of practical education workshops could improve the application of muscle health parameters in clinical practice while contributing to continuous professional development. Developing interprofessional care pathways, particularly between dietitians and physiotherapists, could enhance the practice of muscle health assessment and intervention and requires further exploration.

Author Contributions

Emily Morrin: methodology, formal analysis, investigation, data curation, writing – original draft, visualisation. **Samuel Donnelly:** methodology, formal analysis, investigation, data curation, writing – original draft, visualisation. **Aideen McGuinness:** conceptualisation, methodology, writing – original draft, visualisation, supervision. **Katherine Ford:** methodology, validation, formal analysis, writing – original draft, writing – review and editing, visualisation, supervision. **Anne Griffin:** conceptualisation, methodology, validation, investigation, resources, writing – original draft, writing – review and editing, visualisation, supervision, project administration.

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Declaration of Generative AI and AI-assisted technologies in the writing process: During the preparation of this work the authors used MS Copilot to improve readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Ethics Statement

The study was approved by the University of Limerick Education & Health Sciences Faculty Research Ethics Committee [2023-06-16(ER)].

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Transparent Peer Review

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.