ORIGINAL RESEARCH

Nurse-led coaching to improve dietary protein intake and reduce the risk of sarcopenia in middle-aged women

Kelley L. Jackson[1], Sareen S. Gropper*[1], Deborah D'Avolio[1], Dennis Hunt[2], David Newman[1]

[1] *Christine E. Lynn College of Nursing, Florida Atlantic University, Boca Raton, FL, United States*
[2] *Rehabilitation Sciences, Florida Gulf Coast University, Fort Myers, FL, United States*

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ABSTRACT

Background and objective: An adequate dietary protein intake is critical to preventing sarcopenia, a condition characterized by reductions in muscle mass, strength, and function. The objectives of this investigation were to determine the effectiveness and how telephone-based diet coaching by a nurse practitioner contributed to improving dietary protein intakes in middle-aged women.

Methods: Middle-aged women were recruited, and those randomized to receive nutrition education (including a protein prescription) and weekly diet coaching (focused on improving protein intake) provided weekly responses to three semi-structured interview questions. Qualitative content analysis was used to examine the responses to these questions. Dietary protein intake was analyzed at baseline and the end of the 12-week study from three 24-hour diet recalls at each time point using diet-analysis software and repeated measures analysis of variance.

Results: Coached participants (n = 25) significantly increased dietary protein intake (55.3 $\pm$ 10.3 g at baseline to 83.7 $\pm$ 14.5 g/day at the end of the study); 19 of the 25 participants (76%) met their recommended dietary protein prescription by the study's end. Three themes "Identifying Opportunities for Behavior Change", "Beneficial Behavior Changes", and "Tailoring Individual Interventions" were identified as a result of the coaching and led to the overarching theme "Empowered by Knowledge, Successful by Support" depicting how coaching contributed to the behavior changes.

Conclusions: Nurse-led coaching is an effective approach enabling middle-aged women to improve dietary protein intake. These improvements are especially important in reducing the risk for the development of sarcopenia.

Key Words: Behavior change, Diet coaching, Protein intake

1. INTRODUCTION

1.1 Nature and significance of the problem

Sarcopenia is characterized by reductions in muscle mass, strength, and function. The condition is most often observed in older adults but may begin in adults in their 30s.[1] The changes that occur in muscle with sarcopenia are in turn associated with substantial morbidity, including an increased risk of frailty and falls, along with disability, reduced mobility, loss of independence, and among hospitalized individuals, an increased risk of postoperative complications, longer length of stay, and higher rehospitalization/readmission rates.[2]

The worldwide prevalence of sarcopenia is estimated at 6%-20% among adults 60 years and older.[3] Prevalence findings of 1%-30% among community-dwelling older adult popu-

*Correspondence: Sareen S. Gropper; Email: sgropper@fau.edu; Address: Christine E. Lynn College of Nursing, Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431, United States.

lations and 14%-33% in adults in long-term care facilities have been reported in a systematic review.[4] Prevalence reports ranging from 26%-31% have been also documented in individuals with co-morbidities including cardiovascular disease, dementia, diabetes mellitus, and respiratory diseases.[5] These differences in prevalence are thought to result from varying definitions and diagnostic methods used for sarcopenia.[3]

1.2 Available knowledge

While the causes of sarcopenia have not been entirely identified, an adequate dietary protein intake is known to be one factor that is critical to preventing sarcopenia and attenuating muscle loss.[6,7] However, an investigation of dietary protein intake in adults in the United States shows that intake is frequently inadequate. For example, findings from the National Health and Nutrition Examination Surveys 2005-2014 showed that among 11,680 adults about 45% of females and 31% of males 51-60 years and about 48% of females and 37% of males 61-70 years did not meet the Recommended Dietary Allowance (RDA) (0.8 g/kg body weight) for protein intake.[8,9] These percentages were even higher for adults over 70 years of age.[9] Moreover, protein intakes in excess of the RDA (1.0 to 1.2 g/kg body weight/day) are now being suggested for healthy middle and older-aged adults which translates to an even higher percentage of adults not consuming adequate dietary protein and at risk for sarcopenia.[10–14]

1.3 Problem identified

Improvements in dietary protein intake in research studies have been mainly accomplished by providing study participants with supplements, such as amino acids, protein powders, or other protein-containing products; however, the outcome measures in the studies have focused mostly on the impact of the supplement ingestion on muscle parameters (i.e. mass, strength, function and muscle protein synthesis).[14–18] Further, the use of the supplements, while typically found to increase protein intake during the study's timeframe, may not be sustainable post-study especially if the provided study product is unavailable in the marketplace and secondly, due to taste fatigue, associated with extended consumption of the same food over long time periods.

Nutrition education and counseling represent usual means by which adults with chronic conditions (such as heart, renal, and respiratory diseases, hypertension, diabetes mellitus, and obesity, among others) gain knowledge and skills to assist them in making the requisite changes in their food choices to reduce chronic disease risk factors or control disease-associated manifestations. As evidence has mounted concerning the detrimental effects of sarcopenia, nutritional strategies aimed at preventing the condition among not only older-aged adults, but also middle-aged adults are being recommended.[19] These strategies are also of significance given knowledge about sarcopenia has been found to be limited among community-dwelling adults.[20]

Coaching, including nurse-led coaching, has been used successfully to assist adults with improving food choices to reduce disease risks associated primarily with obesity, type 2 diabetes, and heart disease.[21–25] In addition, it has also been shown to be effective when used in combination with nutrition education in a single-arm pilot study aimed at increasing protein intake in a group of older adults.[26] Given the effectiveness of coaching in these aforementioned studies, this study sought to determine the effectiveness and how coaching by a nurse practitioner contributed to middle-aged women making changes in dietary protein intake. This study fills a gap in the scientific literature; given while there are numerous studies demonstrating the effectiveness of coaching, published studies-to-date have not examined how coaching helped to effect the observed behavior changes.

2. METHODS

2.1 Study design

This 12-week study employed a parallel mixed methods research design. Participants were randomized into either a control (not-coached) or treatment (coached) group. A random generator in excel was used for the randomization process. The quantitative aspect of this mixed methods design was a true experimental pretest posttest design; these quantitative study findings which evaluated per-meal dietary changes and their impact on muscle health (mass, strength and function) have been reported in their entirety elsewhere.[27] Important to note, only the quantitative findings related to overall change in protein intake during the study period are presented in this manuscript to examine the effectiveness of coaching; the qualitative component of the study which explored how coaching led to successful dietary behavior change (i.e. increasing protein intake) in the participants randomized to the treatment (coached) group is showcased herein.

2.2 Study participants

Participants, middle-aged women, were recruited by convenience sampling, including word of mouth and fliers posted at two locations in eastern, South Florida. Criteria for inclusion were: women aged 45-64 years, community-dwelling/living independently, able to understand and answer questions in English, ownership of a functioning telephone for coaching sessions, and agreeable to making dietary changes. Criteria for exclusion included: self-reported kidney disease,

diagnosed eating disorder (current or past), internal cardiac pacemaker/defibrillator, vegan diet, refusal to change diet, or a usual meal-associated daily dietary protein intake in excess of 1.2 g/kg body weight.

2.3 Measures and procedures

Self-reported demographic information (age, education, race/ethnicity), anthropometric indices (height, weight, calculated body mass index), and muscle (mass, strength, and function) parameters were measured at baseline and the end of the study. Anthropometric indices, body composition, and muscle findings are reported elsewhere.[27] Information on nutrient intakes was determined from three (1 weekend day and 2 weekdays) 24-hour dietary recalls collected at baseline and the end of the study. The recalls were obtained using standardized multiple-pass methodology and analyzed for protein intake by a registered dietitian/nutritionist (RDN, and part of the research team) using diet analysis software (Food Processor, ESHA, Salem, OR). Detailed meal-associated protein intake and other nutrient findings are reported elsewhere;[27] total protein intake at baseline and the end of the study are reported as part of this investigation serving to specifically show the impact which diet coaching had on those coached on a weekly basis.

The week following baseline data collection, participants were provided with a protein prescription (0.4 g protein/kg body weight per meal) and nutrition education (scripted to maintain fidelity) by an RDN. Participants randomized to the coached group also began receiving weekly telephone-based coaching; it is those participants randomized to this coached group that are part of the study reported in this manuscript. The coaching sessions were led by a Nurse Practitioner (NP) using the framework of the Theory of Integrative Nurse Coaching.[28,29] Use of this framework enabled the identification of participant goals and specific tailored strategies that set the individuals up for success based on what they were willing and able to do to achieve them.[28] Rapport was established with participants during recruitment, during in-person collection of baseline data, as well as during weekly coaching sessions. Words of encouragement were provided, and successes, even small ones, were celebrated. During the weekly coaching sessions, participants answered the following three semi-structured open-ended questions:

- Describe the obstacles you have experienced in meeting your protein prescription.
- What do you believe led to success while trying to meet your protein prescription?
- How do you believe diet coaching was beneficial throughout this process?

Participant responses to each of the questions were written down on data collection sheets on a weekly basis. Based on responses, coaching strategies were mindfully implemented and included: mutual goal setting, motivational interviewing, open-ended and probing questions, and appreciative inquiry in an effort to encourage participants to increase intake (via self-selection) of dietary protein-rich food sources as part of meals. Explored in this paper are the responses to the three questions and to enable determination of how coaching assisted the participants in increasing their protein intake to meet their protein prescription.

2.4 Data analysis

Descriptive statistics were used to illustrate the sociodemographic characteristics of the sample including age, race/ethnicity group, and education. Repeated measures analysis of variance was used to examine dietary protein intake of the participants at baseline and the end of the study, and was conducted using SPSS version 26.0 (SPSS, Inc., Chicago, IL). Qualitative content analysis (QCA), based on the works of Erlingsson and Brysiewicz,[30] was used to analyze the participants' responses to the three open-ended interview questions. Briefly, following QCA procedures, all written documentation taken during the coaching session interviews for each participant were read through in their entirety, and then re-read to gain a broader sense of what the participants were experiencing before breaking it down into parts. Notes were written down in order to revisit and compare data captured later (reflective process) from the parts of the whole that were created (codes and categories) to ensure the whole is found in the parts and vice versa. The relevant text from the interviews (unit of analysis) that addressed the semi-structured interview questions were divided up into meaning units. The meaning units were then narrowed further into condensed meaning units which preserved the context. As part of the QCA process, intercoder reliability was assessed between the two researchers who both coded the same text data provided by the study participants, reaching 88% consensus. Once all codes were confirmed, descriptive category names were created by comparing the codes and bringing similar codes together. Once the categories were formed, themes were formulated from two or more categories being grouped together, and, with further development, an overarching theme was generated through abstraction. Also, embedded in the approach and used within this study were continuous reflective processes which led to the revisiting of the interview text several times after the initial reading (and re-reading of the interview text). The revisiting of the interview text helped provide additional context and support to category and theme generation.

2.5 Ethical considerations

This study was approved by the University's Institutional Review Board. Participation was voluntary. All questions were answered before the consent form was signed. Confidentiality was assured through coding of provided information from participants. The study is registered at clinicaltrials.gov as NCT04660851.

2.6 Trustworthiness

Several approaches were used to maintain scientific rigor. Investigator triangulation was used as a means of trustworthiness by bringing together observations, different perspectives, data confirmation, and conclusions.[30,31] Credibility was established with peer scrutiny and prolonged engagement.[32] Dependability was established by ensuring content areas of questioning remained unchanged.[33] Confirmability was established by linking interpretations with quotes from the participants, and transferability was established by providing relevant quotations from the participants.[32–34]

3. Results

Of the 56 women who volunteered for the study, two were not eligible based on study criteria and one failed to complete the study due to non-study related reasons. Thus 53 women completed the study and, of the 53 participants, 25 were randomized to the coached group and included in this study's examination of the effectiveness and how coaching contributed to dietary behavior changes. The 25 coached study participants had a mean (SD) age of 55.1 (5.7) years, height of 63.8 (2.5) inches, weight of 139.5 (26.3) pounds, and body mass index of 24.2 (3.9) kg/m2. The coached group was 84% non-Hispanic White, 8% Black, 4% Hispanic, and 5% Asian. Education achieved by the group was 36% post college, 32% 4-year college, 16% some college, 4% Associate degree, 8% high school, and 4% some high school. The 25 participants received a total of 215 coaching sessions (averaging 9 sessions per each participant out of a total of 10 sessions provided as part of the study). Coaching sessions ranged from about 15-30 minutes in length and were set up weekly at a mutually agreeable day and time.

3.1 Protein intake

Protein intake significantly ($p < .001$) increased from 55.3 $\pm$ 10.3 g at baseline to 83.7 $\pm$ 14.5 g/day at the end of the study, and when expressed as g/kg body weight, protein intake significantly ($p < .001$) increased from 0.9 $\pm$ 0.2 g/kg body weight at baseline to 1.3 $\pm$ 0.2 g/kg body weight at the end of the study. Nineteen of the 25 coached participants (76%) met their dietary protein prescription by the end of the study while only six participants (24%) did not. Out of the six participants who did not meet their prescribed daily protein intake, four reported uncontrollable barriers in the final 3 weeks of the study as discussed under theme one.

3.2 Themes

The findings from the qualitative data collected during the coaching sessions provided for the creation of 18 codes and six categories and generated three themes. These themes emerged into one overarching theme depicting how coaching assisted participants in achieving a significantly higher daily protein intake.

3.2.1 *Theme 1: Identifying opportunities for change*

Participants' responses to question 1 (describe the obstacles you have experienced in meeting your protein prescription) led to the identification of two categories, controllable barriers and uncontrollable barriers. Some of the controllable barriers that were identified included deficits in knowledge such as examples of protein-rich food sources, not liking to eat breakfast, lack of discipline for meal planning, needing to make protein a priority at meals, and trying to meet protein intake goals when traveling. Coaching strategies such as appreciative inquiry and mutual goal setting were used to help overcome the reported obstacles. Some examples of weekly goals set by participants during the coaching sessions are shown in Table 1.

Table 1. Examples of Weekly Goals

Get protein at all three meals
Try new (protein-rich) foods based on suggestions
Plan to spend more time food shopping
Meal prep on weekends for week ahead
Eat something for breakfast versus skipping altogether
Paying more attention to food labels
Commitment to use Fitbit to track protein intake
Bring meals to work
Purchase scale to measure portion sizes accurately
Eating a variety of foods to decrease boredom
Review information/education provided from dietitian
Eat protein-rich foods before attending holiday party
Increasing protein sources in morning smoothie .

Some of the uncontrollable barriers included illness/injury, consistent work-related challenges, and holiday events. Within the first 3 weeks of coaching, participants reported 15 uncontrollable barriers interfering with their abilities to meet their protein prescription. During the final weeks of the study, 10 barriers remained, and of the six participants who were unable to meet their protein prescription, over half (67%) reported uncontrollable barriers in the last 3 weeks of the study. The Nurse Practitioner utilized specific coaching strategies such as appreciative inquiry and mutual goal setting to assist with approaches for overcoming these obstacles, however due the nature of these barriers, these strategies had little

influence. These two categories controllable barriers and uncontrollable barriers contributed to the theme, "Identifying Opportunities for Change".

3.2.2 *Theme 2: Beneficial behavior changes*

The participants' responses to the second question (what do you believe led to success while trying to meet your protein prescription?) resulted in several codes including behavior change, and physical and emotional attributes, and awareness. One participant stated, "When I eat protein, I don't feel like munching which causes me to gain weight easily". She made a behavior change and related that change to a positive outcome. Another participant who was not eating breakfast prior to the study stated, "My stomach stopped growling in my 10:30 am meetings once I started eating breakfast". In another example, another participant stated, "Your positive feedback is so helpful!". The categories protein proficiency and positive personal (physical and emotional) outcomes were generated from the analyses of the participant's responses to question 2, and contributed to the second identified theme "Beneficial Behavior Changes".

3.2.3 *Theme 3: Tailoring individual interventions*

Participants' responses to the last question (how do you believe diet coaching was beneficial throughout this process?) resulted in several codes such as education, expert advice, consistency, providing support, and accountable and led to two final categories, gaining knowledge and consistent support. One participant stated, "The coaching calls really help keep me on track". Another participant stated she found coaching "Very helpful to focus on why I need 21 grams of protein at every meal". This quote directly reflected the value expressed by the participant in relation to the knowledge she gained from the diet coaching sessions. The third theme that was created from these categories was "Tailoring Individual Interventions". Examples of tailored interventions are shown in Table 2.

Table 2. Examples of tailored interventions

Re-enforcing nutrition education presented by dietitian
Verbal and visual representation of portion sizes
Provide continued rationale for even distribution of protein with meals
Reviewed information on anabolic resistance.
Providing expert advice

3.2.4 *Overarching Theme – "Empowered by knowledge, successful by support"*

In summary, three general themes "Identifying Opportunities for Behavior Change", "Beneficial Behavior Changes", and "Tailoring Individual Interventions" emerged from a total of 18 codes leading to the generation of 6 categories during data analysis. These three themes merged to reflect the overall theme/benefit of the diet coaching sessions experienced by the participants, "Empowered by Knowledge, Successful by Support". Table 3 shows some examples of the meaning units, codes and categories that resulted from the content analysis. In essence, the participants who received diet coaching benefited from coach continuity (support), weekly consecutive sessions (support), and nutrition education resulting in the ability to apply newly-acquired knowledge into a personal practice for daily protein consumption with a high potential for sustainability with self-selected high-quality dietary protein selections.

Table 3. Emerged study themes

Overarching Theme: Empowered by Knowledge, Successful by Support		
Theme 1: Identifying Opportunities for Behavior Change		
Describe the obstacles you have experienced in meeting your protein prescription.		
Meaning Units	**Codes**	**Categories**
Not knowing how much protein was in the foods I normally eat	Knowledge Deficit	Controllable Barrier
Catered work functions with few protein options	Environment	Uncontrollable Barrier
Theme 2: Beneficial Behavior Changes		
What do you believe led to success while trying to meet your protein prescription?		
Meaning Units	**Codes**	**Categories**
Talking every week about protein	Accountable	Protein Proficiency
Preparing on Sunday for lunches all week	Behavior Change	Protein Proficiency
I feel so much better when I get all my protein for the day! All 3 meals.	Emotional Attributes	Positive Personal (Emotional) Outcomes
Theme 3: Tailoring Individual Interventions		
How do you believe diet coaching was beneficial throughout this process?		
Meaning Units	**Codes**	**Categories**
Teaching me to eat protein in the right amounts at the right times	Education	Gaining Knowledge
Giving new ideas to try	Expert Advice	Gaining Knowledge
Helps me to keep focusing on my protein at every meal	Consistency	Consistent Support
Checking in helps	Consistency	Consistent Support

4. DISCUSSION

The findings of this study demonstrated the effectiveness of nurse-led telephone-based diet coaching but also expanded the scope of coaching. The effectiveness of the coaching was demonstrated by the significant improvements in dietary protein intake observed in the study participants who were coached and the percentage of these participants who met the protein prescription by the end of the study. These dietary improvements are vital given that consumption of adequate amounts of protein is important for adults to reduce the risk of sarcopenia and its associated detrimental effects on health.[10,11,14] The use of diet coaching as a means to assist with behavior change was also expanded as a result of this study to include its use as a means to increase dietary protein intake among middle-aged women. Previous studies have utilized nurse-led coaching,[25,35–38] dietitian-led coaching[39,40] and interdisciplinary (nurse and dietitian)-led coaching[41] to improve dietary behaviors associated with the prevention and/or treatment of primarily type 2 diabetes, heart disease, and obesity (i.e. not sarcopenia).

Yet, perhaps of greater significance is the study's findings illustrating how nurse-led coaching contributed to middle-aged women making the beneficial changes in their dietary protein intake. While there are a growing plethora of studies demonstrating the effectiveness of coaching in promoting behavior change, these studies have not typically addressed how coaching helped to effect behavior change. Key aspects of diet coaching included: building a rapport, helping participants set realistic expectations with mutual but participant-driven goal setting, appreciative inquiry, and asking the participants both open-ended and probing questions through motivational interviewing (engagement). Numerous personal barriers were identified-including a lack of nutrition/dietary protein-related knowledge/education, not having time to eat, not having many available food options, and habits such as meal skipping, among others. Focusing on participant-driven approaches (empowerment) to overcome the identified barriers and to develop interventions (tailored to their life) along with consistent support were also major components employed as part of the coaching. Moreover, the coaching sessions afforded a constant connection with participants, establishment of trust, frequent opportunities to understand barriers, reinforcement of nutrition education, and proposals of alternative options if needed. Other study findings on coaching in general have concurred with the results of this investigation, noting that establishing goals (by the client), creating and maintaining an empathic relationship, using client-centered approaches, enabling client self-efficacy, and providing encouragement are critical for effective health coaching.[24,41–43]

Finally, from a research perspective, this is also the first study to use the Theory of Integrated Nurse Coaching as its theoretical framework to evoke dietary behavior changes and provides for future researchers to consider a nursing-based theory for successful behavior change. Engagement, empowerment, and education are components found in the Theory of Integrative Nurse Coaching[28] which were implemented throughout the coaching sessions, and which led to participants increasing their dietary protein intake. Either alone, or in combination, these three key components have been identified in aforementioned studies examining determinants of successful coaching delivered by nurses.[25,26,35,36,38]

Limitations

This study's relatively small sample size of only women, and who were generally highly educated and primarily non-Hispanic White, pose limitations with regards to the generalizability of the study findings. Coaching, however, continues to emerge in the scientific literature as an effective means of promoting behavior change.

5. CONCLUSIONS

Nurse-led coaching provided an effective means to empower middle-aged women to improve dietary protein intake by identifying opportunities for behavior change, assisting participants in making behavior changes, and tailoring the coaching to the individual. The coaching and its resulting outcomes/behavior changes are especially important in reducing risk factors for the development of sarcopenia. Future studies, however, are needed to examine the sustainability of these changes over time among participants as well as to better determine the number of coaching sessions needed to effect behavior change in participants.

Implications for nursing

Nurses, dietitians, physicians, and other healthcare professionals have the opportunity to provide patients with vital dietary and other lifestyle recommendations to help them to prevent and manage chronic diseases. In discussing diet or food choices with patients, the need to consume adequate amounts of protein-rich foods to maintain muscle health should be included in the conversation. The patient may also need some information on food sources that provide protein. Moreover, while coaching may not be feasible, many of techniques used in coaching can be applied to patient encounters and discussions. For example, as demonstrated in this study, empowering the patient is valuable, that is assist them in identifying both their barriers and developing their own approaches to overcome the barriers to making dietary changes. The use of open-ended questions and reflective inquiry can be helpful techniques. In addition, providing support and

encouragement to the patient even for what may be a seemingly minor accomplishment can help them to succeed. Such a translation of the findings of coaching interventions into evidence-based practice strategies for use in the clinical settings has been suggested as a means of improving patient outcomes.[44]

CONFLICTS OF INTEREST DISCLOSURE

The authors have no conflict of interest to disclose.

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