



Mind the Gap: Exploring Nutritional Health Compared With Weight Management Interests of Individuals with Osteoarthritis

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ABSTRACT

Background: For persons with osteoarthritis (OA), nutrition education may facilitate weight and OA symptom management.

Objectives: The primary aim of this study was to determine preferred OA-related nutritional and weight management topics and their preferred delivery modality. The secondary aim was to determine whether there is a disconnect between what patients want to know about nutrition and OA management and what information health-care professionals (HCPs) are providing to patients.

Methods: The Osteoarthritis Action Alliance surveyed individuals with OA to identify their preferences, categorized in 4 domains: 1) strategies for weight management and a healthy lifestyle; 2) vitamins, minerals, and other supplements; 3) foods or nutrients that may reduce inflammation; and 4) diets for weight loss. HCPs were provided these domains and asked which topics they discussed with patients with OA. Both groups were asked to select currently utilized or preferred formats of nutritional resources.

Results: Survey responses from 338 individuals with OA and 104 HCPs were included. The highest preference rankings in each domain were: 1) foods that make OA symptoms worse (65%), foods and nutrients to reduce inflammation (57%), and healthy weight loss (42%); 2) glucosamine (53%), vitamin D (49%), and omega-3 fatty acids (45%); 3) spices and herbs (65%), fruits and vegetables (58%), and nuts (40%); and 4) Mediterranean diet (21%), low-carbohydrate diet (18%), and fasting or intermittent fasting (15%). There was greater than 20% discrepancy between interests reported by individuals with OA and discussions reported by HCPs on: weight loss strategies, general information on vitamins and minerals, special dietary considerations for other conditions, mindful eating, controlling caloric intake or portion sizes, and what foods worsen OA symptoms. Most respondents preferred to receive nutrition information in a passive format and did not want information from social media messaging.

Conclusions: There is disparity between the nutrition education content preferred by individuals with OA (which often lacks empirical support) and evidence-based topics being discussed by HCPs. HCPs must communicate evidence-based management of joint health and OA symptoms in patient-preferred formats. This study explored the information gap between what individuals with OA want to know and what HCPs believe they need to know. *Curr Dev Nutr* 2022;6:nzac084.

Keywords: osteoarthritis, obesity, nutrition education, dietary patterns, supplements, survey

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Manuscript received February 7, 2022. Initial review completed April 2, 2022. Revision accepted April 12, 2022. Published online April 19, 2022.

This publication was supported by the CDC of the US Department of Health and Human Services (HHS) as part of a financial assistance award (1 NU58 DP006980-01) totaling \$461,914, with 65% funded by the CDC and HHS and 35% funded by nongovernment source(s).

Author disclosures: The authors report no conflicts of interest.

The contents are those of the authors and do not necessarily represent the official views of, nor an endorsement by, the CDC, HHS, or the US Government.

Supplementary Materials are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at <https://academic.oup.com/cdn>.

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Abbreviations used: COVID-19, coronavirus disease 2019; HCP, health-care professional; OA, osteoarthritis; OAAA, Osteoarthritis Action Alliance; UNC-Chapel Hill, University of North Carolina at Chapel Hill.

Introduction

Osteoarthritis (OA) is the most common form of arthritis and affects 32.5 million adults in the United States (1, 2). The estimated economic

burden of OA in the United States is \$136.8 billion annually (1), and the personal burden includes symptoms of pain, stiffness, fatigue, and functional disability, which result in reduced quality of life (3). As there is neither a cure nor effective disease-modifying drug therapies for OA,

interventional strategies often focus on risk factor modification and symptom management. Weight loss is a particularly important management strategy for OA because of its well-documented impact on reducing musculoskeletal pain (4). For example, a 10-pound weight loss has been shown to reduce knee joint loading by 40 pounds, thereby decreasing the risk of OA by 50% (5–7). Moreover, diet-induced weight loss reduces systemic and synovial joint inflammation (8, 9), which may lessen symptoms and cartilage destruction. However, evidence supporting the benefits of nutritional patterns varies and is conflicting (10–20).

As dietary modifications have been found to yield favorable weight loss results (21–23), nutritional strategies surrounding weight loss and anti-inflammatory dietary patterns should be key components to OA management. Specific nutrients (e.g., vitamins D and K, ginger, turmeric) and foods (e.g., berries) are also associated with improvement of OA symptoms and quality of life (24–28). While health-care professionals (HCPs) are on the front line managing OA, HCPs may be time constrained in clinic or may not feel equipped or comfortable counselling patients with OA about symptom and weight management (29, 30). Moreover, nutritional counselling may be insufficiently reimbursed. Thus, only general advice may be given to patients; in fact, fewer than 30% of HCPs provide obesity counselling (31–34) and only 7.6% of patients with OA report receiving nutritional advice from HCPs (35). As a result, patients turn to other resources (e.g., the Internet, social media) for this information.

When polled about their interest in nutrition counselling related to OA management, most patients (79%) were interested in receiving nutrition advice in a variety of formats (35). Another study found that individuals with OA believed that what they eat could impact their health (36). The majority of existing survey-based research investigating nutrition and OA is epidemiological, with a focus on examining roles of specific nutrients and dietary patterns on OA symptoms and progression (24, 25, 37, 38). Moreover, dietary changes made by people with OA are typically done without consulting an HCP or specialist (36). Dietary beliefs about weight and symptom management in people with OA differ among individuals with normal weight, overweight, and obesity (39). More people with overweight and obesity, in contrast to those with normal weight, believe that weight gain and management are influenced by genetics or metabolic factors (39). It is currently unclear whether the specific nutritional interests and needs of patients for managing OA symptoms are being met through interactions with HCPs or available resources.

The primary aim of this study was to determine preferred OA-related nutritional and weight management topics and their preferred delivery modality. The secondary aim was to determine whether there is a disconnect between what patients want to know about nutrition and OA management and what information HCPs are providing to patients. The findings will guide the creation of evidence-based resources to support HCPs in counselling their patients to address their OA-related nutritional interests. The current study is part of the Osteoarthritis Action Alliance's (OAAA's) larger OA prevention strategy, which is to promote policy, research, and intervention efforts that support injury prevention and weight management efforts among individuals with OA.

Methods

Study design

An anonymous, electronic, cross-sectional survey was administered to individuals with OA and HCPs who treat patients with OA. Study procedures were reviewed by the University of North Carolina at Chapel Hill (UNC-Chapel Hill) under IRB # 20–1999 and deemed exempt from federal human subject research regulations.

Patient recruitment

Study materials and links to complete the survey were distributed via the OAAA's social media networks and website, with particular focus on Twitter and Facebook. The OAAA also directly promoted this study to individuals with OA and to HCPs through email communications with members of major OA-related organizations and OAAA partners. Respondents with OA were also recruited through ResearchMatch, a national health volunteer registry that was created by several academic institutions and supported by the US NIH as part of the Clinical Translational Science Award program. ResearchMatch has a large population of volunteers who have consented to be contacted by researchers about health studies for which they may be eligible. Enrollment occurred from 27 July 2020 through 15 February 2021. People with OA were eligible to complete the survey if they were at least 18 years of age, resided in the United States, and had self-reported hip or knee OA. HCPs were included if they resided in the United States and cared for people with OA. HCPs were excluded if they were not currently engaged in patient care or did not provide care to patients with OA.

Survey development

Our interprofessional team consisted of researchers, registered dietitian nutritionists, physicians (geriatrics, rheumatology, internal medicine), athletic trainers, and exercise physiologists. The team reviewed the limited research evidence for dietary practices and beliefs among people with OA to determine areas of interest to the target population (35, 36, 39–41). Evidence was synthesized pertaining to nutrition interventions for OA (24, 42), as well as nutrition knowledge and practices of HCPs (30). Common nutrition-based practices included weight management and referral to other specialists (30). Websites for clinicians and people with OA were reviewed for nutrition topics related to arthritis and risk factors for arthritis (e.g., Arthritis Foundation, Healthline, Medical News Today, Medicine Net, Newsmedical Life Sciences, WebMD). Two surveys were developed in English: the first survey was designed for individuals with hip or knee OA and addressed the primary aims, and the second survey was developed for HCPs who currently provide care to individuals with OA and addressed the secondary aims. Both surveys were reviewed through multiple consultations with a committee of nonparticipating experts in nutrition, as well as an expert in survey design, for structure, content validation, and removal of ambiguity. Surveys were formalized and published using Qualtrics (Drive). Both surveys were completed anonymously.

Informed consent and confidentiality

The opening page of the online survey included a brief description of the survey and information regarding risks, benefits, confidentiality, and voluntary participation. Participants were made aware of the limited individual benefits from participation aside from contributing to novel

knowledge through their involvement; HCPs were not required to complete the survey as a condition of employment. The subsequent page of the survey obtained informed consent from each participant. Individuals who provided informed consent and agreed to participate were then asked a series of screening questions. If the eligibility criteria were met, the participant was then prompted to complete the survey. At the end of the survey, participants were given the option to share their email address with the OAAA so they could be notified when new materials on OA and nutrition were developed; if a participant chose to share their email address, it was collected through a separate online form and stored separately from survey responses in a password-protected file.

Survey content: patients

The survey for individuals with OA was comprised of 2 main sections. The first section focused on themes to determine which nutritional topics the patients considered the most important for OA self-management education. The second section focused on methods of delivering nutritional information that were most appealing to patients (see **Supplementary Material**). Patients were asked to select their top 5 choices (out of 18) of interest for the topic of strategies for weight management and healthy lifestyle. People with OA then selected their top 3 choices (out of 7) for each of the following 3 topics: vitamins, minerals, and other supplements; foods and nutrients that may reduce inflammation; and diets for weight loss. They were asked to select delivery methods that they would use to acquire nutritional information (e.g., face-to-face with HCPs, printed materials, websites, in-person or virtual classes, videos, or emails). Individuals with OA were allowed to choose as many delivery options as they wanted. They were also provided an option for write-in answers if their choice for material delivery was not available. A final, optional section to the survey included self-reported participant characteristics (age, zip code, height, weight, sex, race and ethnicity, and highest education level achieved).

Survey content: HCPs

The survey for HCPs consisted of 3 main parts: 1) topics of nutrition-based discussion during their clinical interactions with patients; 2) opinions of and interest in OA-focused nutrition resources for clinical use; and 3) resources of nutritional information that were most appealing to them for clinical use (see **Supplementary Material**). HCPs were asked in part 1 to identify topics that were broached by patients with OA during their appointments (e.g., weight loss and joint pain, nutritional strategies to reduce joint pain, dietary patterns). HCPs identified specific nutrition topics they discussed with patients; the same list of 18 choices that were provided to patients were listed here, plus a general choice of strategies for weight management and healthy lifestyle. In part 2, HCPs were asked about opinions on nutrition counselling or dietary information for self-management of OA, weight loss counselling, and interest and referral patterns for services to discuss diet issues related to OA. In part 3, HCPs were asked to select the delivery methods of nutritional information they would use if provided; the choices for this question mimicked those given to individuals with OA. As with the individuals with OA, respondents were also provided an option for write-in answers if an answer was not an available choice. The survey also requested that HCPs identify their specific health profession [i.e., primary care physician, subspecialty physician, nurse

practitioner or physician assistant, nurse, rehabilitation professional (therapists, athletic trainers), nutrition professional, exercise professional, other].

Data handling and analysis

The survey was developed using Qualtrics, was licensed through UNC-Chapel Hill, and required survey developers to access the survey data using their UNC-Chapel Hill credentials and 2-factor authentication. Any data downloaded from Qualtrics was stored securely on the OAAA Microsoft Teams drive, which is maintained on a secure University of North Carolina at Chapel Hill server. If participants voluntarily provided their email address, this was done after submitting the Qualtrics survey; subjects were given a link to a separate form where they could enter their email address. Email addresses were stored separately in a password-protected file on the OAAA Microsoft Teams drive. The data analysis occurred via Qualtrics built-in reporting features and Microsoft Excel.

Results

A total of 505 patients consented: 99 were considered ineligible ($n = 18$ non-US residents; $n = 81$ who reported no knee or hip pain) and 338 patients answered at least 1 survey question. A total of 163 HCPs consented: 36 were considered ineligible ($n = 2$ non-US residents; $n = 34$ who were not currently providing care to patients with OA). Of the 127 remaining HCPs, 120 responded with details about their profession and 104 responded to at least 1 survey question. Thus, survey responses from 338 patients and 104 HCPs were included in the results (**Figure 1**). Self-reported participant characteristics are found in **Table 1** (patients) and **Table 2** (HCPs). Respondents with OA were primarily female, White, and held college degrees; over half were classified with a BMI ≥ 30 kg/m² based on self-reported height and weight data. The majority of HCPs identified as a rehabilitation professional (i.e., physical therapist, occupational therapist, athletic trainer), with 27% identifying as a primary care or subspecialty physician.

The 5 most important topics ranked by at least one-third of individuals with OA are summarized in **Table 3**. People with OA want to know what foods may make OA symptoms worse, followed by general information about foods or nutrients to reduce inflammation, and healthy weight loss for older adults. One-third of these individuals reported interest in learning about emotional eating and ways to control it, as well as strategies to feel full and foods that promote feelings of fullness. Consistency was also high for preferences on topics regarding vitamins, minerals, and food or nutrients that may reduce inflammation. Patients reported glucosamine, vitamin D, and omega-3 fatty acids (fatty fish oils) as the top 3 vitamins, minerals, and other supplements as topics of interest. Spices and herbs such as turmeric, ginger, and garlic ranked the highest by individuals with OA among the foods and nutrients that may reduce inflammation, followed by fruits and vegetables and nuts. They shared fewer common interests in specific diets. The Mediterranean diet, low-carbohydrate diet, and fasting and intermittent fasting were ranked by patients as the top 3 diets that they would like to learn more about.

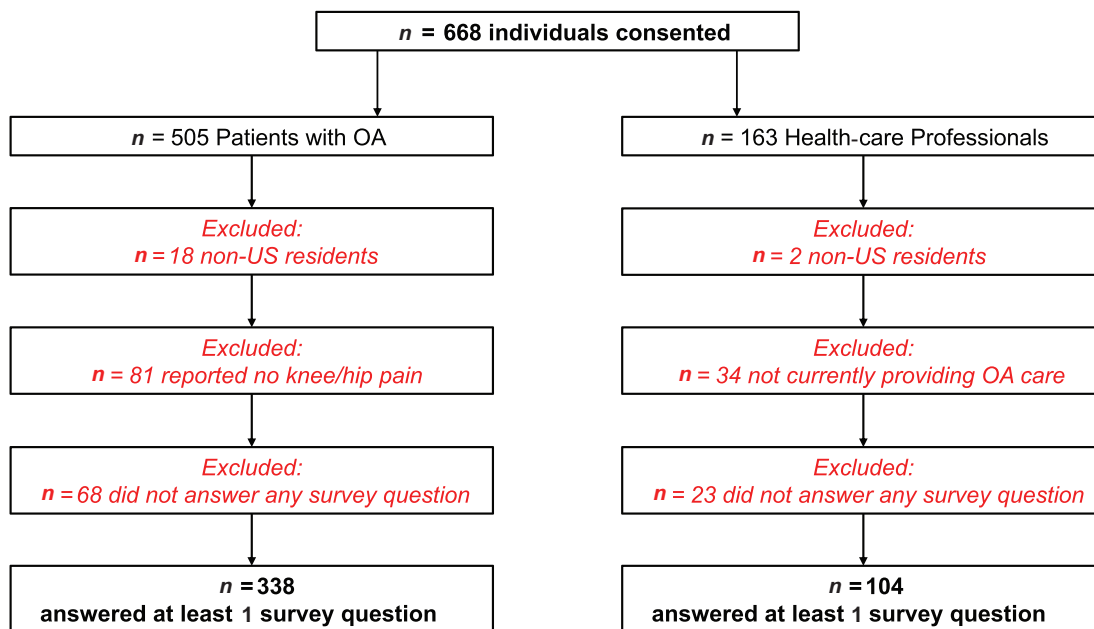


FIGURE 1 Flow diagram of included survey responses. Abbreviation: OA, osteoarthritis.

Table 4 shows the topics that individuals with OA reported as being important to discuss with their HCPs, compared to the topics that HCPs reported discussing with patients during appointments. Discrepant reporting between people with OA and HCPs was considered either large (>20%) or minimal (<20%). The only topic that was important to individuals with OA and discussed by a lower percentage of HCPs was foods that make OA symptoms worse (65% of people with OA ranked this as important compared with 42% of HCPs reporting discussing this with patients). More HCPs reported discussing topics that were not as frequently rated as important to individuals with

OA, with major discrepancies found for the following topics: healthy weight loss for older adults; general information about vitamins, minerals and supplements; special diet considerations for other medical conditions; benefits of mindful eating; effective ways to control caloric intake; effective ways to control portion sizes; how to use food labels to guide food choices; and benefits and cautions of diets for weight loss. Minimal reporting discrepancies existed on all remaining nutrition topics.

Table 5 compares the nutritional interests of OA patient respondents based on their BMI classification. Patients with OA across all BMI categories ranked foods that may make OA symptoms worse and general information about foods and nutrients to reduce inflammation as their top 2 categories of interest. However, 3 categories of interest differ between groups. Individuals with OA and without obesity (BMI < 30 kg/m²) indicated more interest in topics surrounding general health and nutrition, with topics of “healthy snacking: to snack or not to snack—what is effective?,” healthy weight loss for older adults, and general information about vitamins, minerals, and supplements being preferred. Individuals with OA and obesity (BMI ≥ 30 kg/m²) ranked their next topics of interest as those surrounding weight loss and/or management, with topics of healthy weight loss for older adults, emotional eating and ways to control it, and strategies to feel full and foods that promote feelings of fullness as their next top-ranked interests.

The top-ranked sources for patient education reported by people with OA are presented in **Figure 2**. Websites were the most popular. The highest percentage of individuals with OA reported that they were already acquiring information from websites or preferred to get information from this source. Hard-copy resources, such as handouts or brochures, also were popular choices for current information sources and desired resources for future content. Face-to-face interactions were the third most commonly used resource. People with OA indicated the least amount of interest in receiving information

TABLE 1 Characteristics of individuals with OA¹

Characteristic	Value
Age, years (n = 308 responses)	60.3 ± 10.8
Female sex (n = 313 responses)	262 (84%)
Height, cm (n = 298 responses)	166.6 ± 8.8
Weight, kg (n = 307 responses)	92.3 ± 23.6
BMI, kg/m ² , (n = 296 responses)	33.2 ± 8.4
Race and ethnicity (n = 312 responses)	
Black or African American (n = 20)	6.4%
White (n = 267)	85.6%
Hispanic (n = 13)	4.2%
Asian (n = 2)	0.6%
Native Hawaiian (n = 0)	0.0%
Other (n = 2)	0.6%
Prefer not to answer (n = 7)	2.2%
Education level (n = 312 responses)	
<High school (n = 1)	0.3%
High school or GED (n = 17)	5.4%
Some college (n = 81)	26.0%
College (n = 210)	67.0%
Prefer not to answer (n = 3)	1.0%

¹Values are means ± SD or percentage of the group. N = 338 answered at least 1 survey question after screening and consent. Abbreviation: OA, osteoarthritis.

TABLE 2 Characteristics of HCPs¹

HCPs	n (%)
Primary Care or Subspecialty Physician	32 (27%)
Nurse Practitioner or Physician Assistant	1 (1%)
Rehabilitation Professional (PT, OT, or ATC)	67 (56%)
Nutrition Professional, Exercise Professional, or Registered Nurse	12 (10%)
Other	8 (7%)

¹Values are as a percentage of the group; n = 120 answered the profession question. Abbreviations: ATC = certified athletic trainer, HCP, health-care professionals; OT, occupational therapist; PT, physical therapist.

from social media messages, in-person classes, and synchronous online sessions.

Discussion

Nutrition and dietary habits are cornerstones in chronic disease management, yet little is known about how the specific nutrition interests of patients align with the topics discussed by HCPs. We demonstrated that individuals with OA are interested in learning about nutrition topics to improve OA symptoms and are willing to receive this information in a variety of formats; when stratifying for weight status, patients without obesity prefer more generic nutritional health education, while patients with obesity focus on weight management topics. Our results reveal a clear discrepancy between what HCPs are discussing with patients and what information individuals with OA want to hear regarding their disease management, particularly individuals with OA and without obesity.

Regardless of their BMI status, most individuals with OA prioritized information about what foods make OA symptoms worse and nutritional advice to reduce inflammation rather than prioritizing information about weight loss and weight management. Optimal nutrition and physical activity patterns can confer first-line anti-inflammatory benefits against chronic OA inflammation (42, 43). This aligns well with the interest in learning more about anti-inflammatory nutrition and would likely resonate well with patients if provided as a resource or

during clinic interactions. HCPs, however, reported discussing weight loss strategies, general information on vitamins and minerals, special dietary considerations for other conditions, mindful eating, and controlling caloric intake or portion sizes more frequently than providing information on what foods worsen OA symptoms. Many of those topics align more closely with the preferences of individuals with OA and obesity. HCPs may not be providing nutritional information surrounding foods that affect OA symptoms because there are limited conclusive data to inform evidence-based decision making. Thus, HCPs may be more likely to provide information on what research has been shown to be effective, such as weight loss to reduce joint load and inflammation. Almost half of the respondents with OA indicated interest in learning about healthy weight loss strategies. There was less interest from individuals with OA who did not have obesity in weight loss and management strategies than information about foods and nutrients that decrease inflammation and joint pain. The divergence in topic preferences between those with and without obesity indicates the focus of individuals to address their specific conditions (i.e., osteoarthritis, obesity), with little interest in topics that seem to less directly impact their health.

This gap between the interests of what people with OA want to know and what HCPs discuss with patients is important for several reasons. The limited evidence surrounding symptom improvement through specific nutrients and supplements is weak and conflicting (10–16); thus, HCPs are not providing guidance in this space despite patients showing interest. HCPs should be conscious of this gap and clearly communicate the lack of literature supporting some of these preferred topics with

TABLE 3 Most important topics, ranked by individuals with OA, to learn about in relation to joint health¹

Topic	Question	n (%)
Top 5 ranked strategies for weight management and healthy lifestyle (n = 338)	1. What are foods that may make OA symptoms worse	219 (65%)
	2. General information about foods and nutrients to reduce inflammation	191 (57%)
	3. Healthy weight loss for older adults	143 (42%)
	4. Emotional eating and ways to control it	112 (33%)
	5. Strategies to feel full and foods that promote feeling of fullness	110 (33%)
Top 3 ranked topics for vitamins, minerals, and other supplements (n = 321)	1. Glucosamine	171 (53%)
	2. Vitamin D	158 (49%)
	3. Omega-3 fatty acids (fatty fish oils)	144 (45%)
Top 3 ranked topics for foods and nutrients that may reduce inflammation (n = 331)	1. Spices and herbs (such as turmeric, ginger, garlic)	216 (65%)
	2. Fruit and vegetables (such as cruciferous vegetables or dark berries)	192 (58%)
	3. Nuts	131 (40%)
Top 3 ranked diets for weight loss (n = 328)	1. Mediterranean diet	177 (21%)
	2. Low-carbohydrate diet	155 (18%)
	3. Fasting and intermittent fasting	130 (15%)

¹Abbreviation: OA, osteoarthritis.

TABLE 4 Specific nutritional topics related to joint health that are reported to be of interest by individuals with OA and number of HCPs reporting discussing that topic with patients during clinical interactions¹

Topic	Patients want to know (% yes), n = 338	HCPs discuss with patients (% yes), n = 100
Foods that may make OA symptoms worse ²	219 (65%)	42 (42%)
General information about foods and nutrients to reduce inflammation	191 (57%)	57 (57%)
Healthy weight loss for older adults ²	143 (42%)	66 (66%)
Emotional eating and ways to control it	112 (33%)	27 (27%)
Strategies to feel full and foods that promote feeling of fullness	110 (33%)	29 (29%)
Affordable food choices to maximize your joint health and body weight	108 (32%)	19 (19%)
Healthy snacking: to snack or not to snack, what is effective	103 (30%)	38 (38%)
General information about vitamins, minerals, and supplements ²	89 (26%)	50 (50%)
Awareness of your food triggers	85 (25%)	35 (35%)
Special diet considerations for other medical conditions like diabetes, high blood pressure ²	82 (24%)	55 (55%)
Benefits of mindful eating ²	60 (18%)	42 (42%)
Effective ways to control caloric intake ²	57 (17%)	56 (56%)
Effectiveness and cautions for fasting	56 (17%)	30 (30%)
Organic versus regular food and produce: does this matter for OA symptoms?	46 (14%)	12 (12%)
Effective ways to control portion size ²	43 (13%)	53 (53%)
How to use food labels to guide your food choices ²	16 (5%)	35 (35%)
Benefits and cautions of diets for weight loss ²	15 (4%)	42 (42%)
Healthy weight loss for children	5 (1%)	12 (12%)

¹HCPs and individuals with OA were surveyed separately from each other and are not linked (i.e., HCPs surveyed do not provide care to the individuals with OA surveyed). Values are the percentage of the group reporting yes. Abbreviations: HCPs, health-care professionals; OA, osteoarthritis.

²Topics where there is greater than 20% difference between what individuals with OA desire and what HCPs discuss.

patients. People with obesity are often stigmatized in American culture, and even HCPs have been shown to be negatively biased against individuals with obesity (44, 45). Patients' awareness of this bias and their expectations of poor care due to this bias may cause avoidance of care or lower treatment adherence (45). The combination of HCP bias towards only addressing weight loss and patients' avoidance of care may compound the gap between what information is preferred and what is provided. It is also possible that some people with OA do not understand the role of body weight on joint health and OA pain. Education, exercise, and weight loss are effective, nonpharmacological interventions to manage OA (46), but implementation of these strategies assumes a certain level of patient health literacy and requires modification of behaviors. Health education may facilitate compliance in behavior and lifestyle modifications, thus improving the long-term outcomes of these weight management interventions. Therefore, messaging across different media and among HCPs must clearly communicate the connection between nutrition, weight, and OA joint symptoms without judgement or blame. HCPs should discuss weight loss strategies in a compassionate

and positive manner, emphasizing the possibilities of improved functional ability and quality of life from improved nutritional choices.

Patients reported glucosamine, vitamin D, and omega-3 fatty acids among their top vitamins and minerals interests with regards to OA symptoms. Previous research is conflicting surrounding these 3 supplements (10–16, 47–49). Conflicting evidence may be attributed to factors such as disease severity and progression (15), supplement dosages (10–13, 48–50), lengths of interventions (10, 11, 13, 49, 50), and a general lack of physiological or physical disease improvement (14, 50). It is possible that HCPs avoid providing supplement advice as disease management due to the inconclusive nature of the current literature. Nonetheless, if asked, HCPs can acknowledge that there is lacking evidence and agreement on the topic of nutrition and joint health. If comfortable and familiar with the literature, HCPs can communicate the existing evidence to patients rather than not addressing the topic as a whole. For example, it has been reported that turmeric extract improves pain symptoms in patients with knee OA (17) and, in another study, a combination of black pepper, ginger, and turmeric supplementation was found to

TABLE 5 Ranked topics by individuals with OA, by BMI status¹

Topic	BMI <30 kg/m ² (n = 124)		BMI ≥30 kg/m ² (n = 172)	
	n (%)	Rank	n (%)	Rank
What are foods that may make OA symptoms worse?	86 (69.3%)	1	105 (61.0%)	1
General information about foods and nutrients to reduce inflammation	79 (63.7%)	2	92 (53.5%)	2
Healthy snacking: to snack or to not snack what is effective?	42 (33.9%)	3	—	—
Healthy weight loss for older adults	42 (33.9%)	4	81 (47.1%)	3
General information about vitamins, minerals, and supplements	41 (33.1%)	5	—	—
Emotional eating and ways to control it	—	—	68 (39.5%)	4
Strategies to feel full and foods that promote feelings of fullness	—	—	63 (36.6%)	5

¹Abbreviations: OA, osteoarthritis.

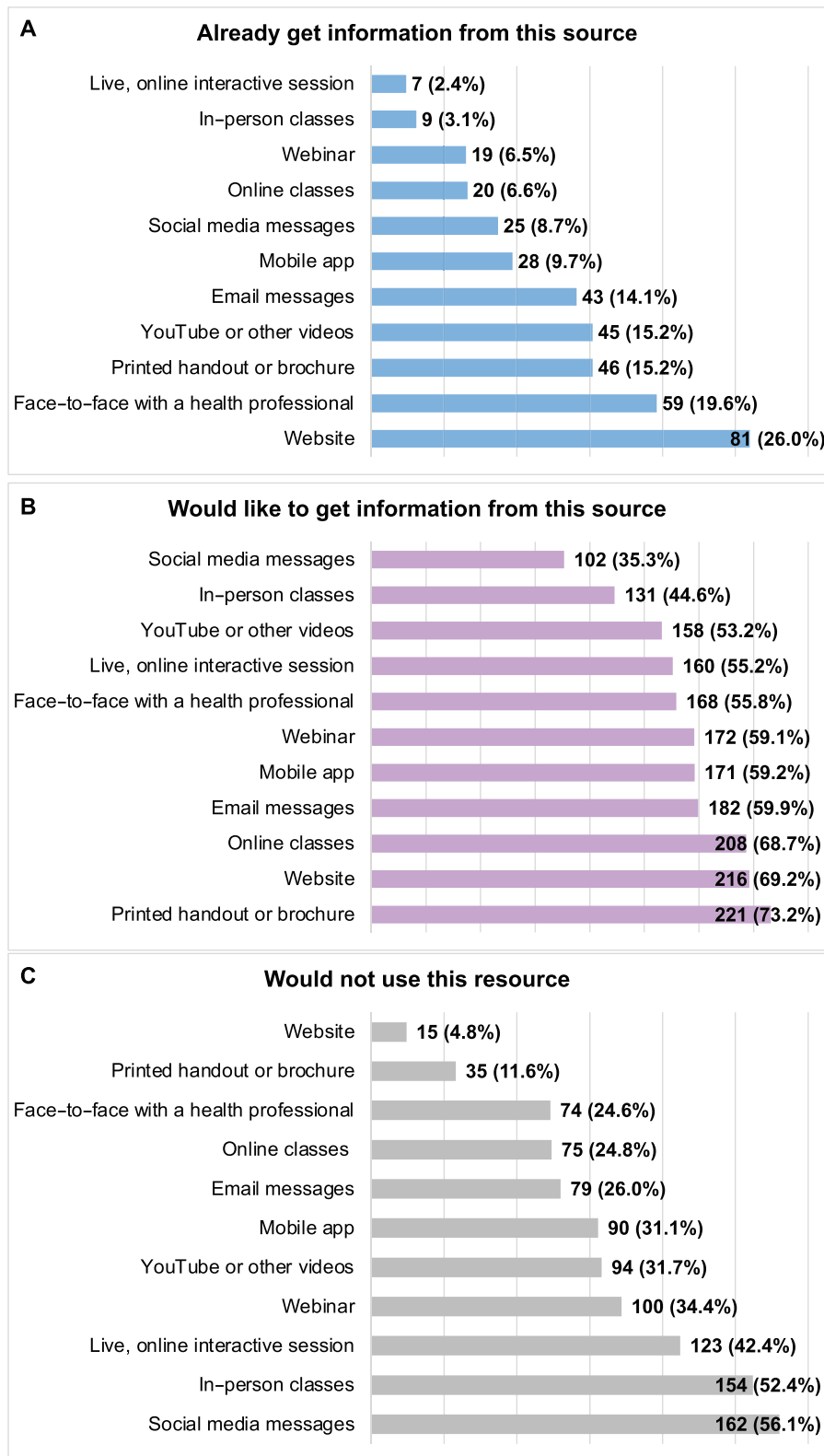


FIGURE 2 Individuals with osteoarthritis' interest in joint health-related nutrition information resources. Values are presented as n (%).

have similar anti-inflammatory effects as Naproxen in individuals with OA (18). Furthermore, recent data suggest that fruits such as strawberries and blueberries improve OA symptoms and decrease inflammation (19, 20). HCPs can provide this evidence to communicate the potential positive effects of turmeric, ginger, and berries on OA symptoms to patients. By providing such information, the patients' interests are met through discussing supplements. It should be noted, however, that there is an overall lesser amount of research surrounding nutrients such as berries, ginger, and turmeric compared to vitamins and minerals such as glucosamine and omega-3 fatty acids. HCPs should consider potential comorbidities and medications of each individual when counselling on supplements.

Given that individuals with OA prioritized OA symptom management, HCPs can use these findings to reframe their approach to discussions to address symptom management to better resonate with patients. Our OAAA group advocates that careful use of vocabulary in conversations surrounding OA symptoms and management can support the importance of weight loss as an effective method to reduce joint pain over the long term. It has been found that terms used by HCPs describing arthritis pathophysiology and rehabilitation were poorly understood and elicited negative emotional responses (51), while empathetic discussions and positive expectations from HCPs have resulted in small to moderate improvements in pain, anxiety, and stress (52). Moreover, it may be beneficial for providers to take a nonpersonal, generic approach so that patients are receptive to the information and do not feel blamed for their arthritis or disease state. Terms such as "self-management" may allow patients to recognize their ability to take control of their OA symptoms; conversely, such terms could lead patients to believe they are to blame for their arthritis and must manage it on their own. Additionally, HCPs can ask patients what questions they have about a given topic rather than asking whether the patient has any questions in general. The findings of this study emphasize the importance of listening to the patients' needs and interests.

Patients in the present study indicated a greater interest towards passive formats to receive information, rather than interactive formats (e.g., handouts/brochures, websites, and online classes). Passive information acquisition is not unique to patients with obesity or OA; it is also the most frequently reported method preferred by patients with other health conditions (53) or in everyday life (54). Passive formats allow patients to process and understand information at a self-directed speed and require less group interaction and personal exposure. It is important that HCPs discuss the varying degrees of efficacy of different weight loss programs and formats, given the passive format's popularity, or refer patients to speak with a registered dietitian about these topics. Patients must understand that their desire for passive programs may not be sufficient for their treatment, which, in turn, may lead to patients being more willing to actively engage in other disease management programs.

Only one-quarter of individuals with OA reported receiving information from websites. The quality of online arthritis information does not meet the recommended accessibility levels and varies greatly (55, 56), thereby resulting in confusion and frustration for individuals using that resource. Despite this downside, and the fact that health literacy can impact the effectiveness of web-based resources, online interventions have been shown to be a cost-effective management approach for those with chronic conditions such as OA (57). Another proposed

intervention format for people with OA is online support groups. Individuals with OA who attended HCP-led support groups reported that key components of successful and meaningful experiences in this space include high accessibility, enjoyment of the experience, and the content discussed (58). Thus, HCP-led web-based interventions may be the compromise that allows for OA patients to receive information in a more passive format while also maintaining the key characteristics of successful weight management programs. Shared decision-making in the HCP-patient dynamic is a key component to successful disease management, as the HCP understands clinical, evidence-based treatments, while the patient can provide insight into what information they are interested in, as well as the preferred format.

Limitations to the study

It should be noted that this study was not without limitations. Survey collection occurred during the height of the coronavirus disease 2019 (COVID-19) pandemic and likely played a role in responses and biases. Over half of the survey respondents indicated they were not interested in receiving information through in-person classes. A bias against social spaces during COVID-19 could result in respondents being uncomfortable with the idea of attending in-person classes at that time. Over half of the people with OA reported that they would not use information from social media messages; social media outlets experienced a rapid change in a crowded information landscape during the pandemic, and suffered from serious credibility issues, perpetual misinformation, and challenges due to trolls and bots (59). Moreover, this study may have additional self-selection bias in the individuals with OA who responded to a survey regarding their OA symptoms and management. These individuals were more likely to be proactive in their approach to managing and learning about their OA compared to patients who chose not to complete the survey. Furthermore, a degree of selection bias may be present: as patient respondents were recruited through ResearchMatch, it is likely that these patients likely prefer information in a web-based format. The majority of HCPs who responded to the survey were rehabilitation professionals (physical therapists, occupational therapists, and certified athletic trainers). Lastly, web-based, anonymous surveys have inherent difficulties with confirming the identity of each respondent, monitoring the number of responses given by a single individual, and accounting for any poorly considered or deliberately incorrect responses.

Conclusions

We discovered a discrepancy between what HCPs are discussing with patients and what nutrition information people with OA want to hear with regard to OA. Regardless of BMI, individuals with OA are interested in learning about nutrition topics to improve OA symptoms and, to a lesser extent, weight management. Individuals with OA and obesity have a greater interest in learning about weight loss and management strategies compared to their counterparts without obesity. Individuals with OA are willing to receive this information in a variety of formats, many of which are passive and can be used when time allows. More HCPs are discussing nutrition issues related to healthy weight loss and management rather than discussing nutritional strategies for OA symptom management. With the evidence from the present study, the OAAA plans to develop evidence-based resources for patients around weight management, joint health, and symptom management. The OAAA

acknowledges the lack of evidence and/or conflicting evidence that specific nutrients and supplements impact OA symptoms, but aims to disseminate knowledge as research is conducted. The OAAA also plans to develop resources for HCPs to discuss weight management effectively and sensitively with patients to aid in the success of lifestyle changes and treatment programs. Resources that are developed by the OAAA will consider patient interests and provide clear messaging on the role of nutrition on healthy weight and joint health.

Acknowledgments

The Osteoarthritis Action Alliance (OAAA) is a national public health coalition committed to increasing awareness about osteoarthritis (OA), promoting evidence-based interventions for OA, and providing resources for public and professional education in support of OA prevention and management. More information and resources for providers and patients are available on the OAAA website (<http://oaaction.unc.edu/>).

The authors thank Sarah D Ohlhorst of the American Society for Nutrition and Kirsten R Ambrose of the Osteoarthritis Action Alliance and Thurston Arthritis Research Center, University of North Carolina at Chapel Hill, for their correspondence and feedback throughout the course of this study and preparation of the article.

The authors' responsibilities were as follows—ANB: assisted in interpretation of data and wrote the manuscript; SPS, HKV, JAB, CBN, LMA, LFC: assisted in the research and survey design, interpreted data, and provided feedback on the manuscript; KFH, NB: supported the survey design and distribution, recruited participants, analyzed data, and provided feedback on the manuscript; and all authors: read and approved the final manuscript.

Data Availability

Data described in the manuscript, code book, and analytic code will be made available upon request pending approval of shared agreement contract.

References

1. Lakey WC, Greyshock NG, Kelley CE, Siddiqui MA, Ahmad U, Lokhnygina YV, et al. Statin intolerance in a referral lipid clinic. *J Clin Lipidol* 2016;10(4):870–9.e3.
2. CDC. Arthritis: national statistics. Washington (DC): US Department of Health & Human Services; 2021. [Internet]. [Cited 2021 Nov 3]. Available from: https://www.cdc.gov/arthritis/data_statistics/national-statistics.html.
3. Hovingh GK, Gandra SR, McKendrick J, Dent R, Wieffer H, Catapano AL, et al. Identification and management of patients with statin-associated symptoms in clinical practice: a clinician survey. *Atherosclerosis* 2016;245:111–7.
4. Hochberg MC, Altman RD, April KT, Benkhalti M, Guyatt G, McGowan J, et al. American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Res* 2012;64(4):465–74.
5. Garstang SV, Stitik TP. Osteoarthritis: epidemiology, risk factors, and pathophysiology. *Am J Phys Med Rehabil* 2006;85(Suppl):S2–S11; quiz S12–4.
6. Messier SP, Gutekunst DJ, Davis C, DeVita P. Weight loss reduces knee-joint loads in overweight and obese older adults with knee osteoarthritis. *Arthritis Rheum* 2005;52(7):2026–32.
7. Messier SP, Mihalko SL, Legault C, Miller GD, Nicklas BJ, DeVita P, et al. Effects of intensive diet and exercise on knee joint loads, inflammation, and clinical outcomes among overweight and obese adults with knee osteoarthritis: the IDEA randomized clinical trial. *JAMA* 2013;310(12):1263–73.
8. Loeser RF, Beavers DP, Bay-Jensen AC, Karsdal MA, Nicklas BJ, Guermazi A, et al. Effects of dietary weight loss with and without exercise on interstitial matrix turnover and tissue inflammation biomarkers in adults with knee osteoarthritis: the Intensive Diet and Exercise for Arthritis trial (IDEA). *Osteoarthr Cartil* 2017;25(11):1822–8.
9. Sun AR, Wu X, Crawford R, Li H, Mei L, Luo Y, et al. Effects of diet induced weight reduction on cartilage pathology and inflammatory mediators in the joint tissues. *Front Med* 2021;8:628843.
10. Arden NK, Cro S, Sheard S, Doré CJ, Bara A, Tebbs SA, et al. The effect of vitamin D supplementation on knee osteoarthritis, the VIDEO study: a randomised controlled trial. *Osteoarthr Cartil* 2016;24(11):1858–66.
11. McAlindon T, LaValley M, Schneider E, Nuite M, Lee JY, Price LL, et al. Effect of vitamin D supplementation on progression of knee pain and cartilage volume loss in patients with symptomatic osteoarthritis: a randomized controlled trial. *JAMA* 2013;309(2):155–62.
12. Sanghi D, Mishra A, Sharma AC, Singh A, Natu SM, Agarwal S, et al. Does vitamin D improve osteoarthritis of the knee: a randomized controlled pilot trial. *Clin Orthop Relat Res* 2013;471(11):3556–62.
13. Jin X, Jones G, Cicuttini F, Wluka A, Zhu Z, Han W, et al. Effect of vitamin D supplementation on tibial cartilage volume and knee pain among patients with symptomatic knee osteoarthritis: a randomized clinical trial. *JAMA* 2016;315(10):1005–13.
14. Fransen M, Agaliotis M, Nairn L, Votrubec M, Bridgett L, Su S, et al. Glucosamine and chondroitin for knee osteoarthritis: a double-blind randomised placebo-controlled clinical trial evaluating single and combination regimens. *Ann Rheum Dis* 2015;74(5):851–8.
15. Frestedt JL, Walsh M, Kuskowski MA, Zenk JL. A natural mineral supplement provides relief from knee osteoarthritis symptoms: a randomized controlled pilot trial. *Nutr J* 2008;7(1):9.
16. McAlindon T, Formica M, LaValley M, Lehmer M, Kabbara K. Effectiveness of glucosamine for symptoms of knee osteoarthritis: results from an Internet-based randomized double-blind controlled trial. *Am J Med* 2004;117(9):643–9.
17. Altman RD, Marcussen KC. Effects of a ginger extract on knee pain in patients with osteoarthritis. *Arthritis Rheum* 2001;44(11):2531–8.
18. Heidari-Beni M, Moravejolahkami AR, Gorgian P, Askari G, Tarrahi MJ, Bahreini-Esfahani N. Herbal formulation “turmeric extract, black pepper, and ginger” versus Naproxen for chronic knee osteoarthritis: a randomized, double-blind, controlled clinical trial. *Phytother Res* 2020;34(8):2067–73.
19. Du C, Smith A, Avalos M, South S, Crabtree K, Wang W, et al. Blueberries improve pain, gait performance, and inflammation in individuals with symptomatic knee osteoarthritis. *Nutrients* 2019;11(2):290.
20. Schell J, Scofield RH, Barrett JR, Kurien BT, Betts N, Lyons TJ, et al. Strawberries improve pain and inflammation in obese adults with radiographic evidence of knee osteoarthritis. *Nutrients* 2017;9(9):949.
21. Robinson JG, Farnier M, Krempf M, Bergeron J, Luc G, Aversa M, et al. Efficacy and safety of alirocumab in reducing lipids and cardiovascular events. *N Engl J Med* 2015;372(16):1489–99.
22. Nordmann AJ, Nordmann A, Briel M, Keller U, Yancy WS, Brehm BJ, et al. Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: A meta-analysis of randomized controlled trials. *Arch Intern Med* 2006;166(3):285–93.
23. Gardner CD, Kiazand A, Alhassan S, Kim S, Stafford RS, Balise RR, et al. Comparison of the Atkins, Zone, Ornish, and LEARN diets for change in weight and related risk factors among overweight premenopausal women: the A TO Z weight loss study: a randomized trial. *JAMA* 2007;297(9):969–77.

24. Thomas S, Browne H, Mobasheri A, Rayman MP. What is the evidence for a role for diet and nutrition in osteoarthritis? *Rheumatology (Oxford)* 2018;57(Suppl 4):iv61–74.
25. Shea MK, Loeser RF, McAlindon TE, Houston DK, Kritchevsky SB, Booth SL. Association of vitamin K status combined with vitamin D status and lower-extremity function: a prospective analysis of two knee osteoarthritis cohorts. *Arthritis Care Res* 2018;70(8):1150–9.
26. Basu A, Schell J, Scofield RH. Dietary fruits and arthritis. *Food Funct* 2018;9(1):70–77.
27. Veronese N, Stubbs B, Noale M, Solmi M, Luchini C, Maggi S. Adherence to the Mediterranean diet is associated with better quality of life: data from the Osteoarthritis Initiative. *Am J Clin Nutr* 2016;104(5):1403–9.
28. Morales-Ivorra I, Romera-Baures M, Roman-Viñas B, Serra-Majem L. Osteoarthritis and the Mediterranean diet: a systematic review. *Nutrients* 2018;10(8):1030.
29. McAlindon T, Felson DT. Nutrition: risk factors for osteoarthritis. *Ann Rheum Dis* 1997;56(7):397–400.
30. Hill D, Boyd A, Board T. Management of symptomatic knee osteoarthritis in obesity: a survey of general practitioners' opinions and practice. *Eur J Orthop Surg Traumatol* 2018;28(6):1183–9.
31. Guglielmo D, Hootman JM, Murphy LB, Boring MA, Theis KA, Belay B, et al. Health care provider counseling for weight loss among adults with arthritis and overweight or obesity—United States, 2002–2014. *Morb Mortal Wkly Rep* 2018;67(17):485–90.
32. Holden MA, Waterfield J, Whittle R, Bennell K, Quicke JG, Chesterton L, et al. How do UK physiotherapists address weight loss among individuals with hip osteoarthritis? A mixed-methods study. *Musculoskelet Care* 2019;17(1):133–44.
33. Grabovac I, Smith L, Stefanac S, Haider S, Cao C, Waldhoer T, et al. Health care providers' advice on lifestyle modification in the US population: results from the NHANES 2011–2016. *Am J Med* 2019;132(4):489–97.e1.
34. Fitzpatrick SL, Wischenka D, Appelhans BM, Pbert L, Wang M, Wilson DK, et al. An evidence-based guide for obesity treatment in primary care. *Am J Med* 2016;129(1):115.e1–7.
35. Amanda Foley JK, Miller M, Halbert J, Crotty M. Osteoarthritis: is more attention to nutritional health required? *Nutr Diet* 2003; 97–103.
36. Grygielska J, Klak A, Raciborski F, Mańczak M. Nutrition and quality of life referring to physical abilities—a comparative analysis of a questionnaire study of patients with rheumatoid arthritis and osteoarthritis. *Reumatologia* 2017;5(5):222–9.
37. Zhang Y, Francis EC, Xia T, Kemper K, Williams J, Chen L. Adherence to DASH dietary pattern is inversely associated with osteoarthritis in Americans. *Int J Food Sci Nutr* 2020;71(6):750–6.
38. Xu C, Marchand NE, Driban JB, McAlindon T, Eaton CB, Lu B. Dietary patterns and progression of knee osteoarthritis: data from the osteoarthritis initiative. *Am J Clin Nutr* 2020;111(3):667–76.
39. Ekram AR, Cicuttini FM, Teichtahl AJ, Crammond BR, Lombard CB, Liew SM, et al. Weight satisfaction, management strategies and health beliefs in knee osteoarthritis patients attending an outpatient clinic. *Intern Med J* 2016;46(4):435–42.
40. Munshi YI, Iqbal M, Rafique H, Ahmad Z, Rasheed S. Role of diet in disease activity of arthritis—a questionnaire based survey. *Pak J Nutr* 2007;7(1): 137–40.
41. Pitta SS, Swamy RK, Devi K, Ayur B, Lakshminpathi A. Assessment of dietary practice among osteoarthritis patients. *Int J Pharm Pharm Sci* 2014;6(6): 578–81.
42. Dean E, Gormsen Hansen R. Prescribing optimal nutrition and physical activity as “first-line” interventions for best practice management of chronic low-grade inflammation associated with osteoarthritis: evidence synthesis. *Arthritis* 2012;2012:560634.
43. Smith B, Craven K, Kolasa K. Diet and osteoarthritis: sharing strategies for reduced pain and improved function when the evidence is limited. *Nutr Today* 2021;56(2):55–61.
44. Lawrence BJ, Kerr D, Pollard CM, Theophilus M, Alexander E, Haywood D, et al. Weight bias among health care professionals: a systematic review and meta-analysis. *Obesity* 2021;29(11):1802–12.
45. Phelan SM, Burgess DJ, Yeazel MW, Hellerstedt WL, Griffin JM, van Ryn M. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obes Rev* 2015;16(4):319–26.
46. Gay C, Chabaud A, Guilley E, Coudeyre E. Educating patients about the benefits of physical activity and exercise for their hip and knee osteoarthritis. Systematic literature review. *Ann Phys Rehabil Med* 2016;59(3): 174–83.
47. Senftleber NK, Nielsen SM, Andersen JR, Bliddal H, Tarp S, Lauritzen L, et al. Marine oil supplements for arthritis pain: a systematic review and meta-analysis of randomized trials. *Nutrients* 2017;9(1):42.
48. Hill CL, March LM, Aitken D, Lester SE, Battersby R, Hynes K, et al. Fish oil in knee osteoarthritis: a randomised clinical trial of low dose versus high dose. *Ann Rheum Dis* 2016;75(1):23–9.
49. Gruenewald J, Petzold E, Busch R, Petzold HP, Graubaus HJ. Effect of glucosamine sulfate with or without omega-3 fatty acids in patients with osteoarthritis. *Adv Ther* 2009;26(9):858–71.
50. Clegg DO, Reda DJ, Harris CL, Klein MA, O'Dell JR, Hooper MM, et al. Glucosamine, chondroitin sulfate, and the two in combination for painful knee osteoarthritis. *N Engl J Med* 2006;354(8):795–808.
51. Barker KL, Reid M, Minns Lowe CJ. What does the language we use about arthritis mean to people who have osteoarthritis? A qualitative study. *Disabil Rehabil* 2014;36(5):367–72.
52. Howick J, Moscrop A, Mebius A, Fanshawe TR, Lewith G, Bishop FL, et al. Effects of empathic and positive communication in healthcare consultations: a systematic review and meta-analysis. *J R Soc Med* 2018;111(7): 240–52.
53. Drummond FJ, Reidy M, von Wagner C, Livingstone V, Drennan J, Murphy M, et al. Health literacy influences men's active and passive cancer information seeking. *Health Lit Res Pract* 2019;3(3):e147–60.
54. McKenzie PJ. A model of information practices in accounts of everyday-life information seeking. *J Doc* 2003;59(1):19–40.
55. Ansani NT, Vogt M, Henderson BA, McKaveney TP, Weber RJ, Smith RB, et al. Quality of arthritis information on the Internet. *Am J Health Syst Pharm* 2005;62(11):1184–9.
56. Chapman L, Brooks C, Lawson J, Russell C, Adams J. Accessibility of online self-management support websites for people with osteoarthritis: a text content analysis. *Chronic Illn* 2019;15(1):27–40.
57. Whitehead L, Seaton P. The effectiveness of self-management mobile phone and tablet apps in long-term condition management: a systematic review. *J Med Internet Res* 2016;18(5):e97.
58. Plinsinga ML, Besomi M, Maclachlan L, Melo L, Robbins S, Lawford BJ, et al. Exploring the characteristics and preferences for online support groups: mixed method study. *J Med Internet Res* 2019;21(12):e15987.
59. Manganello J, Bleakley A, Schumacher P. Pandemics and PSAs: rapidly changing information in a new media landscape. *Health Commun* 2020;35(14):1711–4.