Development and Validation of the Military Eating Behavior Survey

Renee E. Cole, PhD, RDN¹; Julianna M. Jayne, PhD, RDN, CHES²;
Kristie O'Connor, MLA, RD²; Susan M. McGraw²; Robbie Beyl, PhD³; Adam J. DiChiara⁴;
J. Philip Karl, PhD, RD²

ABSTRACT

Objective: To describe the Military Eating Behavior Survey (MEBS), developed, and validated for use in military populations.

Design: Questionnaire development using a 6-phase approach that included item generation, subject matter expert review, cognitive interviewing, factor analysis, test-retest reliability testing, and parallel forms testing.

Setting: US Army soldiers were surveyed at 8 military bases from 2016 to 2019 (n = 1,561).

Main Outcome Measure: Content, face, and construct validity and reliability of the MEBS.

Analysis: Item variability, internal consistency, and exploratory factor analysis using principal coordinates analysis, orthogonal varimax rotation, and scree test (correlation coefficient and Cronbach alpha), as well as consistency and agreement (intraclass correlation coefficient) of test-retest reliability and parallel forms reliability.

Results: Over 6 phases of testing, a comprehensive tool to examine military eating habits and mediators of eating behavior was developed. Questionnaire length was reduced from 277 items to 133 items (43 eating habits; 90 mediating behaviors). Factor analysis identified 14 eating habit scales (hunger, satiety, food craving, meal pattern, restraint, diet rigidity, emotional eating, fast/slow eating rate, environmental triggers, situational eating, supplement use, and food choice) and 8 mediating factor scales (body composition strategy, perceived stress, food access, sleep habits, military fitness, physical activity, military body image, and nutrition knowledge).

Conclusions and Implications: The MEBS provides a new approach for assessing eating behavior in military personnel and may be used to inform and evaluate health promotion interventions related to weight management, performance optimization, and military readiness and resiliency.

Key Words: military personnel, survey methods, questionnaire design, eating behavior (*J Nutr Educ Behav.* 2021;53:798–810.)

Accepted April 29, 2021. Published online June 30, 2021.

INTRODUCTION

Eating habits can be defined as modifiable behaviors and attitudes related to eating patterns,^{1,2} eating rate,^{3,4} food appeal,^{5,6} and food choice,^{6,7} to

include the influence of appetite,^{8,9} satiation,^{6,9} and food rules^{10,11} on dietary intake. Mediators of eating behavior can be defined as factors that influence eating behavior, such as physical activity,^{7,12} sleep habits,¹³

body satisfaction,^{11,14} perceived stress,^{15,16} tobacco and alcohol use,^{17,18} nutrition knowledge,^{19,20} and the eating environment.^{21–23} There is a well-documented relationship between eating habits and mediators of eating behaviors and physical and mental performance, weight status, and overall health.^{24–27}

The US military requires its personnel to maintain physical and mental fitness, readiness, and the Department of Defense develops and encourages participation in health and resilience promotion programs aimed at fostering nutrition- and health-related behaviors.^{28,29} For example, Department of Defense-wide public health campaigns have stressed the importance of eating habits such as increasing fruit and vegetable intake and whole-grain consumption.^{30,31} Despite these

¹US Military–Baylor University Graduate Program in Nutrition, Joint Base San Antonio–Fort Sam Houston, TX

²Military Nutrition Division, US Army Research Institute of Environmental Medicine, Natick, MA

³Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, LA

⁴Combat Capabilities Development Command Soldier Center, US Army Soldier Systems Center, Natick MA

Conflict of Interest Disclosure: The authors have not stated any conflicts of interest.

Address for correspondence: Renee E. Cole, PhD, RDN, Military Nutrition Division, US Army Research Institute of Environmental Medicine, 3599 Winfield Scott Rd, Bldg 2841, Ste 308, Joint Base San Antonio–Fort Sam Houston, TX 78234; Phone: (210) 221-6304; E-mail: renee.e.cole.mil@mail.mil, renee cole136@gmail.com

Published by Elsevier Inc. on behalf of Society for Nutrition Education and Behavior. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>) <https://doi.org/10.1016/j.jneb.2021.04.467>

efforts, US military service members (SMs) do not meet recommended dietary guidelines established for the US population at large and/or more active subpopulations (such as athletes).^{24,32} In addition, more than half (52%) of SMs are overweight (body mass index [BMI] 25.0–29.9 kg/m²), and 17% are obese (BMI ≥ 30 kg/m²),³³ leaving them at risk for weight-related injuries and comorbidities.³⁴ Entry and retention in military service are contingent on meeting service-specific body composition standards.³⁵ Poor eating behaviors may jeopardize SMs' ability to meet those standards, increase the probability of military separation, and increase the risk of chronic disease. Thus, there is interest in understanding the eating habits of SMs, how those behaviors evolve, and the factors shaping that evolution.

The eating habits of SMs and the factors mediating those behaviors may be influenced by unique characteristics of military environments. Military SMs often experience long training days or night operations that are physically demanding, disrupt sleep patterns, and sometimes restrict access to foods and the time allowed for meal consumption. Furthermore, SMs are subject to mandatory body composition testing and appearance standards, noncompliance with which can result in their discharge from the service.³⁵ Those unique environmental mediating factors can shape eating habits by altering perceptions of hunger/satiety signals^{6,7,9,26}; increasing impulsivity, craving, and preoccupation of food^{36–38}; and increasing desire for high-energy/low nutrient-dense foods.^{6,39} By achieving a better understanding of the relationships between unique military environments, eating habits, dietary intake, and related health outcomes, new insights regarding the etiology of unhealthy or disordered eating patterns, unintentional weight gain, altered body satisfaction, and weight cycling in SMs which may subsequently contribute to separation from the service, chronic disease, and injury in this population can be gained (Figure 1).^{16,22,36,37,40–42}

Eating habits and the mediating factors influencing eating behaviors are commonly assessed by quantitative survey methods. This enables longitudinal monitoring of eating habits and mediators of behavior in large cohorts to assess the effectiveness of interventions for modifying behaviors and associations with health and diet-related outcomes. Although numerous validated eating behavior surveys exist, most focus on only 1 specific aspect of behavior, knowledge, or attitude; do not examine an individual in a comprehensive, holistic manner; or have unnecessary or irrelevant content for a military population. Furthermore, to the authors' knowledge, no survey exists that adequately accounts for the unique aspects of military culture and environments that may mediate eating habits in SM. To address this gap, a Military Eating Behavior Survey (MEBS) was developed and validated.

METHODS

Research Design

The development and validation of the MEBS followed best practices in survey development,^{43–53} and involved 6 phases: (1) item generation and development of the draft MEBS, (2) determination of content validity by an expert panel, (3) determination of face validity by cognitive interview of the target population in groups sessions, (4) determination of construct validity (ie, factor development) by exploratory factor analysis, (5) conducting test-retest evaluations to confirm internal consistency and reliability, and (6) performing parallel forms testing to assess the agreement of an electronic survey version (Figure 2). The investigative team consisted of a combination of military and civilian professionals that were registered dietitians, statisticians, behavioral health and consumer science professionals, and survey research experts. The team was involved in discussions and decisions at each stage of the survey development process. All study procedures were approved by the Institutional Review Board of the US Army

Medical Research and Development Command, and all volunteers provided written informed voluntary consent before study participation. In all phases of the study, soldiers were eligible if they were aged ≥18 y, spoke English, and had completed initial military entry training with the exception of the construct validity phase, in which a subset of soldiers (n = 309) were purposefully enrolled during initial military training. Initial military training is when soldiers are first exposed to the military environment, values/beliefs, and requirements. The inclusion of initial trainees at this stage of the survey development was intentional to capture a sample of individuals undergoing this indoctrination process. The inclusion of initial trainees earlier in survey development would not have added value because of their lack of military experience.

Phase 1: Item Generation and Factor Development

Content for the survey was characterized conceptually by 2 main constructs: eating habits and mediators of eating behavior. Eating habits were defined as encompassing food-related behavior, habits, and attitudes related to eating patterns, eating rate, food appeal, food choice, and includes the influence of appetite, satiation, and food rules on dietary intake. Mediators of eating behavior were defined as factors previously documented in literature influencing eating behavior, habits, and attitudes. These mediators included stress, emotions, social and environmental triggers, physical activity, body image, nutrition knowledge, sleep habits, tobacco use, and weight management efforts.

Existing validated questionnaires for measuring constructs of interest were identified by performing a literature search with PubMed and the Defense Technical Information Center (Supplementary Table 1). Thirty-two existing validated questionnaires were identified as potential contributors to these 2 constructs (Supplementary Table 1). The research team identified relevant items (ie,

Figure 1. Military-specific eating behavior and mediators of behavior concept.

questions, statements, and descriptive responses) from the validated surveys and crafted new items specific to the military environment and culture. A pool of 271 items was identified for initial consideration and organized into 2 parts (139 eating habit items and 132 mediating factor items). The verbiage of some items was revised to employ military-specific language (eg, cafeteria was replaced with dining facility/galley), converted to a consistent past-tense format, grouped by time (eg, past 7 days for meal timing and physical activity, past 30 days for lifestyle behaviors, and 6 months for weight management efforts), and some categorical items were converted to 5-point Likert-type scale response options using a consistent format for

scaling throughout the MEBS. Minor adjustments were made to the original validated perceived stress items: unable to was converted to (1) able to cope or (2) able to control, which required reverse coding; and 5-point Likert response options were modified for consistency with other item response options (never, rarely, sometimes, often, and always).

Phase 2: Content Validity

Content validity of the 2-part survey was completed with a 19-member expert review panel. The expert panel consisted of 15 subject matter experts from the government and academia with knowledge or experience in eating habits, weight management, behavioral theory, military culture,

nutrition and performance, and survey development. The panel also included 4 enlisted soldiers who provided their perspective on initial military training and the military eating environment. A separate 4-member military officer panel of certified sports dietitians provided feedback specific to items assessing nutrition knowledge of general and performance nutrition topics. Expert panel members were asked to assess the nonvalidated items to determine if: (1) the item was succinct and clearly written; (2) the item response options adequately captured the information (exclusive and/or exhaustive); (3) the item added value to the proposed factors; (4) the item should be retained; (5) if so, rewording suggestions to improve clarity;

Figure 2. Diagram depicting the development and validation process of the Military Eating Behavior Survey. EH indicates eating habits; MED, mediators of eating behavior; SME, subject matter experts; V, version. Note: The number of items retained in each survey version is denoted as EH or MED in the light gray boxes.

and (6) new item additions to fill a gap area. The panelist's feedback was consolidated into 1 document and reviewed by the research team. Study staff used the expert panel results to direct subsequent modifications and format survey version 1 (V1) for testing.

Phase 3: Face Validity

Face validity was tested using cognitive interviewing techniques⁴⁴ to determine if the draft survey items were interpreted by the target population as intended by the research team. Ethnographic qualitative research with a purposive sampling strategy was conducted through

group cognitive interview sessions to understand the thought process of participants as they answered survey items.⁵⁴ Group cognitive interview sessions were designed to discuss the understandability of language, appropriateness, applicability, format, and interpretation of survey V1 items and identify gap areas not previously identified that could contribute to further factor and/or construct definition.

A recruitment goal of 1:10 officer-to-enlisted and female-to-male ratios were sought to represent current US Army demographics during face and construct validity phases.⁵⁵ There is no consensus on the exact sample size required for qualitative cognitive

interview methodology; however, the literature supports a sample size between 20 and 60 participants divided into groups of ≤ 10 as sufficient to reach response saturation in which no new themes arise.^{54,56} Forty-four participants were recruited, provided informed consent in advance, and participated in scheduled cognitive interview sessions. Sessions were conducted by study team members experienced in qualitative methodology following rehearsal sessions to ensure consistency among the 3 interview facilitators.

Group interviewer procedures recommend limiting the group size < 12 participants⁴⁴; however, groups

of 4–7 military participants were chosen to foster ample discussion in a welcoming environment while accommodating the size of the interview room. Each cognitive interview session was conducted over a 4-hour time period that included at least two 15-minute breaks. Participants were given 1 hour to complete the MEBS survey V1, were asked to mark confusing or questionable items, and annotate any specific thoughts on individual items. After consolidating all of the survey comments, the facilitator interviewed the participants as a group, using a probing method in which survey items were read aloud, and participants were asked to verbalize their thoughts as they decided how to respond. The facilitator focused initially on items marked by participants to ensure they were addressed within the allotted time. Cognitive interview sessions were also audio recorded with participant approval. Study staff listened to recorded interviews to ensure all concerns, suggestions, and gap areas were captured and consolidated for review.

The verbal responses in the cognitive interview recordings were consolidated into 1 document and reviewed by the research staff. The assessment included determining if each item was interpreted and comprehended as intended or presented cultural or level of education concerns. Research staff agreed on suggestions for clarification, changes to survey formatting and instructions, removal and revisions of items, and the creation of new questions related to survey gap areas. Follow-up cognitive interview sessions with the same participants were conducted on newly revised items to verify proper interpretation and comprehension. Study staff used the interview results to direct subsequent modifications to the survey version 2 (V2). The original section title (ie, Eating Behaviors) was changed to eating habits to prevent respondent confusion with mediators of eating behavior.

Phase 4: Construct Validity

Construct validity was assessed by pretesting the survey to ensure convergent and discriminant validity of

the proposed factors from version 2 (V2) to version 4 (V4) (Figure 2). Testing determined item variance, internal consistency, and reliability to develop the structure of the survey through exploratory factor analysis, guided item removal, and shaped the final draft before Phase 5 (test-retest validity).^{57,58} The sample size for exploratory factor analysis was based on the ratio of volunteers to items. O'Rourke and Hatcher⁵⁹ recommend that a ratio of at least 10:1 be used to ensure well-powered results. The largest number of items for any proposed factor was 21, requiring a sample size of 210 per testing iteration for a homogenous sample; however, the enrollment goal was 400 participants per testing iteration for adequate power given the sample diversity (male/female, enlisted/officer, and training/regular duty assignment) and the potential for missing data (estimated at 20%).

Participants in Phase 4 testing were enrolled in or had completed initial military entry training. They were recruited from the following 7 military installations over 3 iterations: Fort Jackson, SC (initial entry trainees only) and Joint Base Lewis-McChord, WA (V2 survey testing: January–March 2017); Joint Base San Antonio, TX, Fort Riley, KS, and Fort Carson, CO (V3 testing: May–August 2017); and Fort Campbell, KY and Joint Base Elmendorf-Richardson, AK (version 4 [V4] testing: February 2018). Half of the participants completed the eating habits survey first, whereas the other half completed the mediators of eating behavior survey first, with a scheduled break to reduce bias associated with survey fatigue. Study staff was available to answer questions and review surveys for missing data.

Both eating habits and mediating factors were revised, if needed, on the basis of the variance explained by each factor after testing each survey version. Analyses were conducted using SAS (version 9.4, SAS Institute Inc, 2013) and included assessing item variability, internal consistency reliability, and exploratory factor analysis. Item variability was examined to determine if items provide variability within the responses and were completed using descriptive

analysis of response frequencies.⁶⁰ Exploratory factor analysis is a data reduction technique to identify the relationship between (or internal structure) for a set of variables.⁵⁷ To define the factor structure of the survey and reduce extraneous items, the data were subject to a principal coordinates analysis (PCA) and orthogonal variance maximizing (varimax) rotation of the original variable space.⁵⁹ For PCA analysis, the factors were based on an analysis of the total variance in the original data. The initial analysis examined the correlation matrix set at a perfect correlation of 1, implying that 100% of the variance is common or shared between the variables. The varimax rotation was used to re-orient and refine the factor loading obtained from PCA. The goal was to maximize the variability of the factor while minimizing the variance around the factor. Items were retained if they have a factor loading of ≥ 0.35 on a factor and if the item loaded ≥ 0.3 on only 1 factor. A Scree test was performed to determine the number of factors to be retained.^{57,59} Each pretest iteration resulted in repeat PCA and varimax rotation analysis to provide the best fit of survey items to define the factors and/or subscales. Sample diversity (sex, assignment, and rank) was accounted for during analysis.

Internal consistency was examined using Cronbach alpha, which measured how well each item agreed with other items within each proposed factor. This enabled creation of a scale (an additive set of items that describe the eating habit or mediator factor represented as a point score), maximized variability of the scale, and minimized the variance around the scale.⁶¹ Cronbach alpha was computed for each version of the survey to further reduce the number of items. Items were retained if they had an absolute alpha value factor loading of ≥ 0.5 .^{57,60} A Cronbach alpha value of 0.7–0.8 was defined as acceptable, whereas a value of >0.8 was defined as preferred.⁶² Analysis was conducted both iteratively and by combining all of the data into the final analysis. Assumptions about missingness of data were investigated using a statistical test derived from Little.⁶³

Following each testing iteration, descriptive data were analyzed with SPSS software (version 25, IBM Corp, Armonk, NY, 2017), and factor analysis results were discussed by the research team. Removal and revisions to existing items were discussed and agreed on by the research team. The survey was reformatted after testing each survey version, and the revised survey was tested at the subsequent iterations (V2–V4), resulting in V5 for test-retest reliability testing. The readability of the final version (ie, V5) identified a Flesch readability ease at 58.3 and a Flesch-Kincaid grade level of 7.9.

Phase 5: Test-Retest Reliability

The purpose of the survey test-retest was to assess the consistency of participant responses on the MEBS V5 when administered to the same participant on 2 separate occasions. Thirty-two soldiers were recruited from the Natick Soldier System Center in Natick, MA, from August to December 2018, and 30 participants completed the MEBS (V5) and demographic surveys on 2 separate occasions, approximately 1 week apart. One week separation is considered sufficient time to reduce the risk of survey response recall while short enough time to mitigate a major life event influencing responses.^{64–66}

To examine test-retest reliability, consistency, and agreement, the intraclass correlation coefficient (ICC) was examined, comparing participant data at both time points using SPSS software. A 2-way mixed-effect model with absolute agreement defined reliability. The ICC estimate was defined as moderate (ICC, 0.50–0.74), good (ICC, 0.75–0.90), or excellent (ICC, >0.90) with 95% confidence.⁶⁷ The research team discussed analysis results and confirmed the survey was ready for the final parallel forms testing (V5).

Phase 6: Parallel Forms Reliability

Similar to the test-retest analysis, reliability was assessed between 2 formats: a paper survey and an electronic survey accessed via an internet link. Thirty soldiers were recruited from Joint Base Lewis-

McChord, WA, in April 2019. Twenty-five soldiers completed the test-retested MEBS (V5) and demographic surveys on 2 occasions separated by 1 week and assigned in a random format order (paper-online vs online-paper). To examine parallel forms reliability, consistency, and agreement, the ICC was examined using the same parameters described previously.⁶⁷

Scale Examination Between Common Military Groups

Data collected from MEBS (V5), consolidated from Phases 4–6, were stratified by sex, military rank, BMI weight status, and age groupings to examine differences in established scales by commonly assessed groups within the military population. Scale score results were reported as mean $\pm$ SD. Independent sample *t* test or Mann-Whitney U analyses were conducted on the basis of meeting parametric assumptions. Alpha was set at 0.05 with 80% power.

RESULTS

A summary of survey activities and participant demographics during Phases 2–6 are presented in [Table 1](#), with specific noteworthy results from the survey development process reported below.

The Military Eating Behavior Survey comprises 43 eating habits and 90 mediating behavior items, 22 validated scales, and takes 30–60 minutes to complete.

Phase 3: Face Validity

Forty-four Army soldiers participated in >19 cognitive interviewing sessions. In addition to the revisions noted in [Table 1](#), a unique addition was made to the 40-item nutrition knowledge assessment. The majority of participants (73%) acknowledged guessing on most of the nutrition

knowledge assessment items. As the intent of the knowledge assessment is to inform future nutrition interventions, the research team agreed that beyond true or false responses per item, a column should be included asking about confidence in his/her answer (yes/no). In addition, the researchers identified that the body image/satisfaction items did not accurately define the construct from a military perspective. Thus, 16 new body image items were created to replace the initial body image/satisfaction items. A cognitive interview session was included to verify the new items. The items were tested as a stand-alone subset with 6 participants who tested the original questions, as well as with 4 new participants in the complete survey format. The new body image questions were adequately interpreted as intended and deemed more appropriate by participants.

Phase 4: Construct Validity

Three survey versions were tested using a total of 1,462 soldiers ([Table 1](#)). Participants were predominately male (83%), enlisted (94%), unmarried (64%), White (63%), with post-secondary education (51%). Factor analysis began with V2 of the survey with 140 items in eating habits and 123 items in mediators of eating behavior. [Figure 2](#) depicts how the survey evolved to a V5 containing 43-items in Part 1: Eating Habits and 90-items in Part 2: Mediators of Eating Behavior ([Supplementary Tables 2 and 3](#) include factor loading results). The estimated time for participants to complete the survey decreased from 1.5–2 hours in V1 to 35–60 minutes in V5 (3–5 minutes demographic survey, 15–30 minutes for Part 1, and 15–30 minutes for Part 2).

Exploratory factor analysis indicated 14 eating habit scales and 8 mediating scales ([Table 2](#) and [Supplementary Tables 2 and 3](#)). Each confirmed scale was scored by adding the response coding for each item in that factor to yield a point range. For example, the hunger scale comprised 2 items scored on a 5-point Likert scale (0, never; 1, rarely; 2, sometimes; 3, often; and 4, always). The

Table 1. Summary of Military Eating Behavior Survey Revisions During the Content, Face, and Construct Validity and Reliability Phases

Phase Information	Content Validity (Phase 2)	Face Validity (Phase 3)	Construct Validity (Phase 4)	Test-Retest Reliability (Phase 5)	Parallel Forms Reliability (Phase 6)
Study Activity	SME review	19 Cognitive interviews	3 Survey test iterations	Survey test wk 1 and retest wk 2	2 Survey formats tested wk 1 and 2
Participants	No participants 15 SMEs, 4 enlisted soldiers, and 4 sports dietitians officers	Recruited and completed: 44 41 M/3 F 40 E/4 O	Recruited: 1,605 Completed: 1,462 1,218 M/244 F 1,364 E / 93 O/5 U Age: 23.5 ± 5.2 y	Recruited: 32 Completed: 30 28 M/3 F 39 E/OE Age: 22.7 ± 4.8 y	Recruited: 32 Completed: 25 21 M/4 F 20 E/5 O Age: 28.1 ± 6.0 y
Locations/sessions	SMEs from academia and military in a variety of locations	NSSC	493 (FJS, JBLM) 523 (FCC, FRK, JBSA) 446 (JBER, FCK)	NSSC	JBLM
Summary	74 survey items impacted ^a ; 66 revised for clarity, grammar, or to reduce the burden; 13 item response options altered; 7 items deleted; 8 items added	184 survey items impacted; 73 revised for clarity, grammar, or to reduce burden ^c ; 81 item response options altered ^d ; 8 items deleted; 22 items added ^e	247 survey items impacted; 42 word choice revised ^b ; 46 item response options altered ^b ; 1 food security item added; 3 items moved from EH to MED; 155 items deleted ^f	No changes made to survey; Scales were confirmed; Survey includes a 23-item nutrition knowledge assessment and military demographic questions	No changes made to survey
Revised Survey Version	V1	V2	V3–V5	V5	V5
Part 1: EH items	153	140	43	43	43
Part 2: MED items	124	123	90	90	90

E indicates enlisted; EH, eating habits items; F, female; FCC, Fort Carson, CO; FCK, Fort Campbell, KY; FJS, Fort Jackson, SC; FRK, Fort Riley, KS; JBLM, Joint Base Lewis-McChord; M, male; MED, mediators of eating behavior items; NSSC; Natick Soldier Systems Center, MA; O, Officer; SME, subject matter experts; U, Unknown rank (not reported).

^aTwenty items had more than 1 type of revision made; thus, summed no. of items revised does not equal total items impacted; ^bRevised to reflect military language for Army Reserve Officer Training Corps, Air Force, Navy, Marine, and Coast Guard, revised body image items, and improved instructions; ^cConverted 12 items from choose best option statements to single statements within the 5-point Likert scale item section; converted Perceived Stress Scale items no. 2 and 6 to able to (from unable to); ^dIncluded the N/A (not applicable) response option on 51 items and confident (Y/N) column with the true/false responses on the 40-item nutrition knowledge assessment; converted Perceived Stress Scale 5-point Likert Scale to the following: never, rarely, sometimes, often, and always, for consistency with other survey items; ^eIncluded 16 items to assess military body image/satisfaction; ^fDeleted items by each testing iteration: 46 items from the first iteration, 71 items from the second iteration, and 37 items from the third iteration.

hunger scale score ranges from 0 to 8 points. The higher the score, the greater the hunger. The scores for all scales are identified in [Table 3](#), with additional details about the item composition of each factor scale and scoring interpretation provided in [Supplementary Tables 2 and 3](#).

Eight eating habit items and 29 mediating behavior items were not identified for factor scales but were retained in the MEBS. These items do not contribute to a scale score but yield adequate item variance, internal consistency, and reliability, as they provide relevant descriptive information to understand the population (eg, meal location, work schedule, eating style and reason, weight management efforts and reasons, and use of nutrition assistance programs).

The Military Eating Behavior Survey can be administered on paper or through an online platform, increasing population reach.

The 40-item nutrition knowledge assessment was reduced to 23-items on the basis of item variance and initial factor analysis results; however, not all items factor together because of distinct knowledge concepts. Items focused on general health and nutrition performance most relevant to military operations: macronutrients (8 items), micronutrients (7 items), hydration (3 items), and energy sources (5 items). Current scoring mechanisms for knowledge assessments only account for correct vs incorrect responses and cannot differentiate between correct responses that result from actual knowledge and those that result from guessing. Current scoring mechanisms also cannot identify incorrect responses in which participants are confident in their inexperience. Determining whether participants are guessing (whether correctly or not) and their confidence in the responses may help discriminate erroneous from factual knowledge and might be useful for tailoring nutrition education and combating misinformation. To address this, the investigative team

adopted a novel scoring mechanism that accounts for participant confidence (guessing by participants). Scoring was assigned on a 4-point scale for each item: 0, incorrect and confident; 1, incorrect and not confident (guessing); 2, correct and not confident (guessing); 3, correct and confident. The 23-items totaled for a score ranging from 0 to 69 points. A higher score represents accurate knowledge, whereas a lower score indicates a lack of knowledge. Collectively using the new scoring mechanism yielded an acceptable Cronbach alpha, excellent test-retest internal consistency, and good parallel forms internal consistency ([Table 3](#)). Results indicated that data were completely missing at random.

Phase 5: Test-Retest Validity

Thirty participants completed both surveys ([Table 1](#)). Participants were predominately male (93%), enlisted (100%), unmarried (83%), White (79%), with postsecondary education (45%). Of the 22 scales, 1 had no test-retest variability, 8 met moderate internal consistency (ICC, 0.50–0.74), 10 met good internal consistency (ICC, 0.75–0.90) and 3 met excellent internal consistency (ICC, >0.90) ([Table 2](#)). The 3 subscales comprising the Military Body Image Scale met either good or excellent internal consistency ([Table 2](#)). No changes were made to V5 because of all scales assessing various aspects of eating habits that are relevant to SMs.

Phase 6: Parallel Forms Validity

Twenty-five participants completed the paper and internet survey formats ([Table 1](#)). Participants were predominately male (84%), enlisted (80%), married (64%), White (68%), and with postsecondary education (80%). Of the 22 scales, 4 met moderate internal consistency (ICC, 0.50–0.74), 14 met good internal consistency (ICC, 0.75–0.90), and 4 met excellent internal consistency (ICC, >0.90), demonstrating the interchangeability of paper and online survey formats ([Table 2](#)). The 3 subscales

comprising the Military Body Image Scale met either good or excellent internal consistency ([Table 2](#)). Mean $\pm$ SD scale score results for MEBS (V5) consolidated data (n=501) are reported by sex, military rank (enlisted vs officer), weight status (<25 vs $\geq$ 25 kg/m²), and age group (18–22 y vs 23–42 y) ([Table 3](#)). Significant differences were identified between commonly assessed military groups. Males exhibited higher scores than females in satiety, fast eating rate, situational eating, performance supplements, agreement with the military's ideal physique, and physical activity. In contrast, females scored higher than males in emotional eating, slow eating rate, general health supplements, body composition strategies, and food access. Enlisted soldiers scored higher than officers in perceived stress, satisfaction with body shape, and physical activity; however, officers scored higher than enlisted soldiers in meal pattern, diet rigidity, situational eating, general and performance supplements, food choice, sleep habits, military fitness, and nutrition knowledge. Participants who had a BMI in the normal range (18.5–24.9 kg/m²) scored higher than those with a BMI in the overweight range (25.0–29.9 kg/m²) in meal patterns and slow eating rate. In contrast, overweight participants scored higher than normal-weight participants in restraint, dietary rigidity, performance supplements, body composition strategies, the military body image total score and subscale scores, and nutrition knowledge. Soldiers aged 23 y and older scored higher than younger soldiers (18–22 y) in dietary rigidity, emotional eating, general health supplements, body composition strategies, sleep, and nutrition knowledge.

The Military Eating Behavior Survey provides a new comprehensive approach for assessing eating behaviors in a military population.

Table 2. Validity Statistics by Factor for the Military Eating Behavior Survey

Construct and Scale	Cronbach α^a	Test-Retest ICC ^b	Parallel Forms ICC ^c
Eating Habits			
Hunger	0.67	0.649**	0.683**
Satiety	0.71	0.711**	0.845***
Food craving	0.75	0.792***	0.704**
Meal pattern	0.76	0.673**	0.933***
Restraint	0.76	0.920***	0.915***
Dietary rigidity	0.73	0.892***	0.820***
Emotional eating	0.84	0.613**	0.844***
Fast eating rate	0.72	0.844***	0.921***
Slow eating rate	0.65	0.856***	0.742**
Environmental triggers	0.78	0.699**	0.898***
Situational eating	0.63	0.607*	0.829***
General health supplement	0.52	NV	0.785***
Performance supplement	0.82	0.914***	0.849***
Food choice (HES-7)	0.52	0.887***	0.941***
Mediators of Eating Behavior			
Body composition strategy	0.87	0.815***	0.734**
Perceived stress	0.87	0.879***	0.889***
Food access	0.68	0.717**	0.808***
Sleep habits	0.55	0.775***	0.895***
Military fitness	0.68	0.879***	0.783***
Physical activity quantity	0.67	0.675**	0.838***
Military body image scale	0.60	0.874***	0.871***
Concern with military image	0.54	0.793***	0.821***
Satisfaction with body shape	0.88	0.904***	0.776***
Agreement with ideal military physique	0.63	0.742***	0.894***
Nutrition knowledge	0.72	0.915***	0.865***

HES indicates Healthy Eating Score; ICC, intraclass correlation coefficient; NV, no variance.

^an = 1,462; ^bn = 30; ^cn = 25.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Note: Cronbach alpha (factor loading using exploratory factor analysis; 0.7–0.8 was defined as acceptable, whereas > 0.80 was defined as preferred; 2-way mixed-effects reliability model with absolute agreement at $ICC \geq 0.70$ with 95% confidence); NV were all no use responses.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The validated MEBS provides a new comprehensive tool to characterize the relationship between eating habits and mediators of eating behavior in military personnel. Many valid nutrition-related behaviors, attitudes, and knowledge survey tools were considered during the development of the MEBS. Most have a narrow focus, unable to provide a holistic assessment in the context of the unique aspects of military culture and environment. In addition, content and face validity testing indicated that not all items from survey tools previously available were relevant to and understandable by military populations, and not all the items from those previous survey tools used the same response format.

Hence, the MEBS was created to consolidate questionnaires assessing different eating habits constructs and reduce redundancy while revising questions/concepts adapted from other validated surveys using military language to increase comprehension and standardize response options. Those revisions subsequently required a systematic, phased approach using best practice methods to create,^{43,49,52} operationally define,^{44,49,53,54,57,59,60,66} and validate^{45–51,65,67} the eating habits and mediators of behavior constructs identified by the MEBS. The result is a comprehensive, standardized, holistic, and valid tool to examine eating habits and mediators of eating behavior in US military personnel.

Military personnel live and work in a unique culture that includes physically, emotionally, and

cognitively demanding activities that often result in restricted food access, elevated stress, and sleep deprivation, all of which may influence eating habits. Developing undesirable eating habits could be an unintended consequence of that culture that ultimately may make maintaining body composition standards more difficult and increase injury and chronic disease risk during and after military service. As such, the MEBS will enable a better understanding of the eating habits of SMs and the factors mediating those behaviors, which is required for developing empirically based, effective interventions for improving military health, weight management, performance optimization, and military readiness and resiliency. In addition, the MEBS provides an approach to assess the effectiveness of nutritional strategies

Table 3. Mean and SD of Military Eating Behavior Survey Scale Results (n = 501) by Sex, Military Rank, Body Mass Index Status, and Age

		Mean Point Score (SD) by Demographic Category Grouping							
Scale	Score Range ^a	Male (n = 453)	Female (n = 48)	Enlisted (n = 444)	Officer (n = 56)	< 25 kg/m ² (n = 234)	≥ 25 kg/m ² (n = 267)	18–22 y (n = 278)	23–42 y (n = 233)
Hunger	0–8	2.9 (1.7)	2.5 (1.5)	2.8 (1.7)	3.1 (1.5)	2.8 (1.7)	2.8 (1.6)	2.7 (1.7)	3.0 (1.6)
Satiety	0–20	5.9 (3.5)*	4.8 (2.7)	5.8 (3.6)	5.8 (2.8)	5.6 (3.3)	5.9 (3.6)	5.6 (3.5)	5.9 (3.4)
Food craving	0–8	3.1 (1.9)	3.3 (1.6)	3.1 (1.9)	3.2 (1.7)	3.1 (1.9)	3.1 (1.9)	3.1 (2.0)	3.1 (1.8)
Meal pattern	0–21	16.4 (4.4)	16.1 (4.3)	16.1 (4.5)***	18.5 (3.3)	16.8 (4.3)*	16.1 (4.5)	16.1 (4.6)	16.8 (4.2)
Restraint	0–16	5.9 (3.6)	6.7 (3.1)	5.9 (3.6)	6.5 (3.2)	4.5 (3.4)***	7.2 (3.3)	5.5 (3.6)	6.6 (3.5)
Dietary rigidity	0–16	10.2 (3.1)	10.8 (2.6)	10.1 (3.2)***	11.9 (2.5)	9.8 (3.1)**	10.7 (3.0)	10.0 (3.2)***	10.7 (3.0)
Emotional eating	0–12	2.7 (2.7)**	3.6 (2.2)	2.7 (2.8)	3.0 (2.1)	2.5 (2.5)	3.0 (2.9)	2.6 (2.7)*	2.9 (2.7)
Fast eating rate	0–12	6.4 (2.5)***	4.9 (2.0)	6.2 (2.5)	6.3 (2.9)	6.0 (2.5)	6.4 (2.5)	6.2 (2.4)	6.2 (2.7)
Slow eating rate	0–8	2.4 (1.7)*	2.9 (1.7)	2.4 (1.6)	2.5 (1.8)	2.7 (1.7)**	2.2 (1.6)	2.5 (1.6)	2.4 (1.7)
Environmental triggers	0–12	4.9 (2.5)	5.3 (2.5)	4.9 (2.5)	5.1 (2.5)	5.2 (2.5)	4.8 (2.5)	5.1 (2.5)	4.8 (2.5)
Situational eating	0–12	4.0 (1.4)*	3.5 (1.4)	3.9 (1.4)*	4.3 (1.2)	3.9 (1.3)	3.9 (1.5)	3.9 (1.4)	4.0 (1.4)
Supplement use									
General health	0–3	0.3 (0.7)***	0.6 (0.7)	0.3 (0.6)***	0.7 (0.7)	0.3 (0.6)	0.4 (0.7)	0.3 (0.6)***	0.5 (0.8)
Performance	0–4	1.0 (1.4)***	0.3 (0.5)	0.9 (1.3)**	1.5 (1.6)	0.8 (1.3)*	1.1 (1.4)	0.9 (1.4)	1.0 (1.4)
Food choice (HES-7)	0–35	18.0 (5.5)	19.5 (4.8)	17.9 (5.5)**	20.0 (4.6)	18.1 (5.5)	18.2 (5.4)	17.7 (5.6)	18.6 (5.2)
Body composition strategy	0–6	0.9 (1.5)*	1.3 (1.6)	1.0 (1.5)**	0.5 (1.1)	0.4 (0.9)***	1.4 (1.7)	0.8 (1.4)*	1.1 (1.6)
Military perceived stress	0–40	14.6 (6.6)	14.8 (5.4)	14.8 (6.6)*	13.0 (5.0)	14.2 (6.1)	15.1 (6.8)	14.9 (6.3)	14.3 (6.7)
Food access	0–12	8.9 (2.1)***	9.7 (1.7)	8.9 (2.1)*	9.6 (1.9)	9.0 (2.1)	9.0 (2.1)	8.9 (2.1)	9.2 (2.1)
Military body image scale									
CMI	4–20	34.1 (7.2)	32.7 (7.8)	34.1 (7.4)	33.0 (5.9)	32.0 (7.0)***	35.7 (7.1)	33.6 (7.5)	34.4 (7.0)
SBS	5–25	12.0 (3.0)	11.7 (3.4)	11.9 (3.1)	12.3 (2.6)	11.7 (3.0)*	12.3 (3.0)	11.8 (3.2)	12.3 (2.8)
SBS	5–25	13.5 (4.2)	13.3 (3.8)	13.6 (4.2)*	12.5 (3.9)	12.6 (4.2)***	14.2 (4.0)	13.4 (4.2)	13.5 (4.1)
AMP	3–15	8.6 (2.3)*	7.7 (2.8)	8.5 (2.4)	8.2 (2.0)	7.7 (2.1)***	9.2 (2.3)	8.4 (2.3)	8.6 (2.4)
Sleep habits	0–8	4.7 (1.7)	4.9 (1.7)	4.6 (1.7)**	5.3 (1.5)	4.8 (1.7)	4.6 (1.6)	4.5 (1.7)*	4.9 (1.6)
Military fitness test	0–100	86.9 (10.0)	88.5 (9.9)	85.9 (10.0)***	95.6 (5.0)	87.8 (9.0)	86.3 (10.8)	86.4 (10.0)	87.7 (10.0)
Physical activity level, min/d		102.6 (82.5)***	68.5 (45.4)	102.1 (82.9)**	75.6 (46.6)	92.9 (70.0)	104.9 (88.3)	97.5 (66.0)	101.5 (95.3)
Nutrition knowledge	0–69	41.8 (9.2)	44.1 (9.7)	40.9 (8.8)***	50.6 (8.6)	41.0 (8.9)*	42.8 (9.5)	40.0 (7.8)***	44.4 (10.3)

AMP indicates agreement with ideal military physique; CMI, concern conforming to military image; HES, Healthy Eating Score; SBS, satisfaction with body shape.

^aScales comprise a varying number of items with an additive point score on the basis of item response options (Supplementary Tables 2 and 3 define items and score interpretation).

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Note: Independent sample t test comparison for body mass index and age groups and Mann-Whitney U comparison for sex and rank group.

aimed at modifying diet-related behaviors and associated health outcomes.

Several limitations are worth noting. The heterogeneous sample of male enlisted soldiers enrolled in Phase 4 was representative of current Army sex and rank proportions; however, future assessment with a larger sample size of officers and females, and greater demographic diversity, is warranted to increase generalizability. Scales that comprised <3 items should be interpreted with caution. The MEBS contained 2 highly correlated items for the hunger, food craving, slow eating rate, sleep, and physical activity scales. In addition, 7 of the created scales did not have a desired Cronbach alpha >0.7, warranting future reassessment with a robust representative sample.

In summary, this newly developed and validated survey enables examination of eating habits and mediating behavior factors and demonstrated sensitivity to identify significant differences in sex, rank, weight status, and age, all commonly assessed groups within the military population. The survey imposes a relatively low subject burden and can be administered to large cohorts in person or a web-based format. As such, the MEBS will enable future large military cohort studies to include a validated and standard method for assessing longitudinal eating habits change over the course of military careers, and the factors that mediate those changes to include sex, rank structure, military occupations, and environmental exposures.

ACKNOWLEDGMENTS

The views expressed in this article are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the US government. This study was funded by the Army Medical Research and Development Command. The soldiers who participated in this research are gratefully acknowledged, and the research staff, soldiers, and dietetic interns who assisted with study implementation and data collection. Dr Andrew

Young is also acknowledged for editorial assistance.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jneb.2021.04.467>.

REFERENCES

- Bachman JL, Phelan S, Wing RR, Raynor HA. Eating frequency is higher in weight loss maintainers and normal-weight individuals than in overweight individuals. *J Acad Diet Assoc*. 2011;111:1730–1734.
- Zhu Y, Hollis JH. Associations between eating frequency and energy intake, energy density, diet quality and body weight status in adults from the USA. *Br J Nutr*. 2016;115:2138–2144.
- Hermans RC, Hermesen S, Robinson E, Higgs S, Mars M, Frost JH. The effect of real-time vibrotactile feedback delivered through an augmented fork on eating rate, satiation, and food intake. *Appetite*. 2017;113:7–13.
- Karl JP, Young AJ, Rood JC, Montain SJ. Independent and combined effects of eating rate and energy density on energy intake, appetite, and gut hormones. *Obesity (Silver Spring)*. 2013;21:E244–E252.
- Burger KS, Cornier MA, Ingebrigtsen J, Johnson SL. Assessing food appeal and desire to eat: the effects of portion size & energy density. *Int J Behav Nutr Phys Act*. 2011;8:101–110.
- Hopkins M, Gibbons C, Caudwell P, Blundell JE, Finlayson G. Differing effects of high-fat or high-carbohydrate meals on food hedonics in overweight and obese individuals. *Br J Nutr*. 2016;115:1875–1884.
- Blundell JE, Cooling J. Routes to obesity: phenotypes, food choices and activity. *Br J Nutr*. 2000;83(suppl 1):S33–S38.
- Outland L, Rust F. Why disrupt homeostasis? Reasons given for not eating when hungry and not stopping when full. *Holist Nurs Pract*. 2013;27:239–245.
- Feinle-Bisset C. Modulation of hunger and satiety: hormones and diet. *Curr Opin Clin Nutr Metab Care*. 2014;17:458–464.
- de Ridder D, Adriaanse M, Evers C, Verhoeven A. Who diets? Most people and especially when they worry about food. *Appetite*. 2014;80:103–108.
- Tsai SA, LvN, Xiao L, Ma J, Ma J. Gender differences in weight-related attitudes and behaviors among overweight and obese adults in the United States. *Am J Mens Health*. 2016;10:389–398.
- Loprinzi PD, Smit E, Mahoney S. Physical activity and dietary behavior in US adults and their combined influence on health. *Mayo Clin Proc*. 2014;89:190–198.
- Knutson KL. Sleep duration and cardiometabolic risk: a review of the epidemiologic evidence. *Best Pract Res Clin Endocrinol Metab*. 2010;24:731–743.
- Goldschmidt AB, Wall MM, Zhang J, Loth KA, Neumark-Sztainer D. Overeating and binge eating in emerging adulthood: 10-year stability and risk factors. *Dev Psychol*. 2016;52:475–483.
- Lemmens SG, Rutters F, Born JM, Westerterp-Plantenga MS. Stress augments food ‘wanting’ and energy intake in visceral overweight subjects in the absence of hunger. *Physiol Behav*. 2011;103:157–163.
- Jayne JM, Ayala R, Karl JP, et al. Body weight status, perceived stress, and emotional eating among US Army Soldiers: a mediator model. *Eat Behav*. 2020;36:101367.
- Eichen DM, Conner BT, Daly BP, Fauber RL. Weight perception, substance use, and disordered eating behaviors: comparing normal weight and overweight high-school students. *J Youth Adolesc*. 2012;41:1–13.
- An R. Beverage consumption in relation to discretionary food intake and diet quality among US adults, 2003 to 2012. *J Acad Nutr Diet*. 2016;116:28–37.
- Kullen CJ, Farrugia JL, Prvan T, O'Connor HT. Relationship between general nutrition knowledge and diet quality in Australian military personnel. *Br J Nutr*. 2016;115:1489–1497.
- Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge and dietary intake. *Br J Nutr*. 2014;111:1713–1726.
- English L, Lasschuijt M, Keller KL. Mechanisms of the portion size effect. What is known and where do we go from here? *Appetite*. 2015;88:39–49.
- Petrovich GD. Forebrain networks and the control of feeding by environmental learned cues. *Physiol Behav*. 2013;121:10–18.

23. Meye FJ, Adan RA. Feelings about food: the ventral tegmental area in food reward and emotional eating. *Trends Pharmacol Sci.* 2014;35:31–40.
24. Beals K, Darnell ME, Lovalekar M, et al. Suboptimal nutritional characteristics in male and female soldiers compared to sports nutrition guidelines. *Mil Med.* 2015;180:1239–1246.
25. Purvis DL, Lentino CV, Jackson TK, Murphy KJ, Deuster PA. Nutrition as a component of the performance triad: how healthy eating behaviors contribute to soldier performance and military readiness. *US Army Med Dep J.* 2013;66–78.
26. Fagnant HS, Armstrong NJ, Lutz LJ, et al. Self-reported eating behaviors of military recruits are associated with body mass index at military accession and change during initial military training. *Appetite.* 2019;142:104348.
27. Hruby A, Lieberman HR, Smith TJ. Self-reported health behaviors, including sleep, correlate with doctor-informed medical conditions: data from the 2011 Health Related Behaviors Survey of U.S. Active Duty Military Personnel. *BMC Public Health.* 2018;18:853.
28. Defense Health Agency. Survey of health-related behaviors. Military Health System; 2018. <https://www.health.mil/Military-Health-Topics/Access-Cost-Quality-and-Safety/Health-Care-Program-Evaluation/Survey-of-Health-Related-Behaviors>. Accessed December 31, 2020.
29. US Department of Defense. *Department of Defense Directive, Number 1010.10. Health Promotion and Disease/Injury Prevention.* US Department of Defense; 2003. https://www.med.navy.mil/sites/nepmu2/Documents/health_promotion/DoDD1010-10HP%20signed.pdf.
30. US Army Public Health Center. Learn about nutrition. <https://p3.amedd.army.mil/performance-learning-center/nutrition>. Accessed December 31, 2020.
31. US Air Force Medical Service. US Air Force Health Promotion: nutritional fitness. <https://www.airforcemedicine.af.mil/Resources/Health-Promotion/Nutritional-Fitness/>. Accessed December 31, 2020.
32. Smith TJ, Dotson LE, Young AJ, et al. Eating patterns and leisure-time exercise among active duty military personnel: comparison to the Healthy People objectives. *J Acad Nutr Diet.* 2013;113:907–919.
33. Centers for Disease Control and Prevention. Defining adult overweight & obesity. <https://www.cdc.gov/obesity/adult/defining.html>. Accessed June 9, 2021.
34. US Army Public Health Center. Health of the Force; Report. <https://phc.amedd.army.mil/topics/campaigns/hof/Pages/default.aspx>. Accessed December 31, 2020.
35. Department of the Army. *Army Regulation 600-9: The Army Body Composition Program.* July 16, 2019. <https://www.armyresilience.army.mil/ard/images/pdf/Policy/AR%20600-9%20The%20Army%20Body%20Composition%20Program.pdf>. Accessed June 9, 2021.
36. Pandit R, de Jong JW, Vanderschuren LJ, Adan RA. Neurobiology of overeating and obesity: the role of melanocortins and beyond. *Eur J Pharmacol.* 2011;660:28–42.
37. Egecioglu E, Skibicka KP, Hansson C, et al. Hedonic and incentive signals for body weight control. *Rev Endocr Metab Disord.* 2011;12:141–151.
38. Pla-Sanjuanelo J, Ferrer-Garcia M, Gutierrez-Maldonado J, et al. Identifying specific cues and contexts related to bingeing behavior for the development of effective virtual environments. *Appetite.* 2015;87:81–89.
39. Camilleri GM, Mejean C, Kesse-Guyot E, et al. The associations between emotional eating and consumption of energy-dense snack foods are modified by sex and depressive symptomatology. *J Nutr.* 2014;144:1264–1273.
40. Jayne JM, Blake CE, Frongillo EA, et al. Trajectories of body mass index among active-duty U.S. Army soldiers, 2011–2014. *Prev Med Rep.* 2019;14:100818.
41. Rush T, LeardMann CA, Crum-Cianflone NE. Obesity and associated adverse health outcomes among US military members and veterans: findings from the millennium cohort study. *Obesity (Silver Spring).* 2016;24:1582–1589.
42. Montani JP, Schutz Y, Dulloo AG. Dieting and weight cycling as risk factors for cardiometabolic diseases: who is really at risk? *Obes Rev.* 2015;16(suppl 1):7–18.
43. Rattray J, Jones MC. Essential elements of questionnaire design and development. *J Clin Nurs.* 2007;16:234–243.
44. Willis GB. *Cognitive Interviewing: A Tool for Improving Questionnaire Design.* SAGE Publications, Inc; 2005.
45. Burton LJ, Mazerolle SM. Survey instrument validity part II: validation of a survey instrument examining athletic trainers' knowledge and practice beliefs regarding exertional heat stroke. *Athl Train Educ J.* 2011;6:36–46.
46. Jones AM, Lamp C, Neelon M, et al. Reliability and validity of nutrition knowledge questionnaire for adults. *J Nutr Educ Behav.* 2015;47:69–74.
47. Kliemann N, Beeken RJ, Wardle J, Johnson F. Development and validation of the Self-Regulation of Eating Behaviour Questionnaire for adults. *Int J Behav Nutr Phys Act.* 2016;13:87.
48. Presser S, Couper MP, Lesser JT, et al. et. Method for testing and evaluating survey questions. *Public Opin Q.* 2004;68:109–130.
49. Clark LA, Watson D. Constructing validity: new developments in creating objective measuring instruments. *Psychol Assess.* 2019;31:1412–1427.
50. Begdache L, Marhaba R, Chaar M. Validity and reliability of Food-Mood Questionnaire (FMQ). *Nutr Health.* 2019;25:253–264.
51. Woynarowska-Soldan M, Panczyk M, Iwanow L, Zarzeka A, Gotlib J. Validation of the positive health behaviours scale: a nationwide survey of nurses in Poland. *Int J Occup Saf Ergon.* 2019;25:76–85.
52. Boparai JK, Singh S, Kathuria P. How to design and validate a questionnaire: A guide. *Curr Clin Pharmacol.* 2018;13:210–215.
53. Drennan J. Cognitive interviewing: verbal data in the design and pretesting of questionnaires. *J Adv Nurs.* 2003;42:57–63.
54. Moser A, Korstjens I. Series: practical guidance to qualitative research. Part 3: sampling, data collection and analysis. *Eur J Gen Pract.* 2018;24:9–18.
55. Department of Defense. 2017 Demographics: Profile of the military community. <http://download.militaryonesource.mil/12038/MOS/Reports/2017-demographics-report.pdf>. Accessed December 31, 2020.
56. Mason M. Sample size and saturation in PhD studies using qualitative interviews. *Qual Soc Res.* 2010; 11: Article 8.
57. Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Pract Assess Res Eval.* 2005;10:7.
58. Streiner DL. Starting at the beginning: an introduction to coefficient alpha and internal consistency. *J Pers Assess.* 2003;80:99–103.

59. O'Rourke N, Hatcher L. *A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling*. 1st ed. SAS Institute Inc; 2013.
60. Knowles ES, Condon CA. Does the rose still smell as sweet? Item variability across test forms and revisions. *Psychol Assess*. 2000;12:245–252.
61. Chan LL, Idris N. Validity and reliability of the instrument using exploratory factor analysis and Cronbach's alpha. *Int J Acad Res Bus Soc Sci*. 2017;7:400–410.
62. Cortina JM. What is coefficient alpha? An examination of theory and applications. *J Appl Psychol*. 1993;78: 98.
63. Little RJA. A test of missing completely at random for multivariate data with missing values. *J Am Stat Assoc*. 1988;83:1198–1202.
64. Marx RG, Menezes A, Horovitz L, Jones EC, Warren RF. A comparison of two time intervals for test–retest reliability of health status instruments. *J Clin Epidemiol*. 2003;56:730–735.
65. Parmenter K, Wardle J. Development of a general nutrition knowledge questionnaire for adults. *Eur J Clin Nutr*. 1999;53:298–308.
66. Streiner DL, NG. *Health Measurement Scales: A Practical Guide to Their Development and Use*. Oxford University Press; 1992.
67. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficient for reliability research. *J Chiropr Med*. 2016;15: 155–163.

JNEB's new Aims and Scope

The Journal of Nutrition Education and Behavior (JNEB), the official peer-reviewed journal of the Society for Nutrition Education and Behavior since 1969, serves as a global resource to advance nutrition education and behavior related research, practice, and policy. JNEB publishes original research, as well as papers focused on emerging issues, policies and practices broadly related to nutrition education and behavior. These topics include, but are not limited to, nutrition education interventions; theoretical interpretation of behavior; epidemiology of nutrition and health; food systems; food assistance programs; nutrition and behavior assessment; and public health nutrition. Strategies to implement nutrition education, such as policy, systems, and environmental approaches or technological advances are also considered. Skill development within interventions, such as food procurement and culinary expertise; physical activity partnered with nutrition education; and strategies to reduce food insecurity are valued.

In addition to Research Articles and Briefs, JNEB accepts Intervention Methods, Questionnaire Development Methods, Perspectives, Reports, Meta-analysis and Systematic Reviews, and GEMS (Great Educational Materials that have an evaluative component). Reviews of Educational Materials are invited. JNEB encourages data sharing to enhance scientific integrity. The procedure for submitting possible topics for position papers of SNEB can be found at https://www.jneb.org/content/policy_position_papers, and calls for papers related to specific themed issues are also available at <https://www.jneb.org/>.