

AN ASSESSMENT OF DIETETICS AND NUTRITION GRADUATE PROGRAM
STUDENTS' KNOWLEDGE, ATTITUDES, AND BEHAVIORS REGARDING THE
SUBJECT OF MICROPLASTICS

By

Gabrielle M. Arnes, B.S.

A Project Submitted in Partial Fulfillment of the Requirements

for the Degree of

MASTER OF SCIENCE

in

Dietetics and Nutrition

University of Alaska Anchorage

May 2023

APPROVED:

Carrie King, Ph.D., Committee Chair

Amanda Walch, Ph.D., Committee Member

Jeremy Nettleton, Ph.D., Committee Member

LeeAnne Carrothers, Ph.D., Assistant Dean

School of Allied Health

Kendra Sticka, Ph.D., Associate Dean of Clinical Health Sciences

College of Health

Abstract

Microplastics exist in every aspect of our lives, from the ground and ocean to food and clothing. It is becoming more and more evident that microplastics can have negative effects on the environment, human health and food safety. This study examined Accreditation Council for Education in Nutrition and Dietetics (ACEND) accredited graduate program (GP) students' knowledge, attitudes, and behaviors towards microplastics. An electronic survey was sent to ACEND GP program directors (n = 56) to forward to their GP students. Among the 30 students who completed the full survey, 83.3% had previously heard of microplastics. Although almost all participants had heard of microplastics, the impact of this awareness was not consistently reflected in their responses. The majority of participants strongly agreed that microplastics have a negative impact on human health (n = 16, 53.3%). In terms of microplastics and concern about the effect on their own personal health, the majority of students either strongly agreed (n = 6, 20.0%) or agreed (n = 14, 46.7%) that it was a concern. All participants who completed the knowledge section of the survey (n = 25) selected that people ingest microplastics without knowing. However, not all students selected that microplastics can be found in frequently consumed items or in the human body. Most participants selected yes (n = 22, 88.0%) when asked if microplastics could be inhaled unknowingly, but only 60% (n = 15) answered that microplastics were present in the atmosphere. Furthermore, 100% (n = 25) of students who had previously heard of microplastics indicated that they were found in aquatic life, but 53.3% (n = 16) said that they consumed fish weekly, illustrating a disconnect. There is a need to raise awareness of microplastics and settle discrepant results. Further research needs to explore the understanding and behaviors of GP students' involvement in sustainable food systems, including the topic of microplastics particularly, within entry-level RDN education.

Table of Contents

	Page
Title Page.....	i
Abstract.....	iii
Table of Contents.....	iv
List of Tables.....	v
List of Appendices.....	vi
Introduction.....	1
Literature Review.....	2
Research Question.....	5
Research Goal and Objective.....	5
Methods.....	5
Analysis.....	7
Results.....	7
Discussion.....	17
Strengths and Limitations.....	20
Conclusions.....	21
Dietetics and Nutrition Practice Implications.....	22
References.....	23
Appendices.....	27

List of Tables

	Page
Table 1. Participants Demographics.....	9
Table 2. Reported Knowledge of Microplastics.....	10
Table 3. Reported Participant Attitudes on Microplastics.....	12
Table 4. Reported Participant Behaviors on Microplastics.....	14

List of Appendices

	Page
Appendix A - Original and Modified Survey Questions.....	27
Appendix B - University of Alaska Anchorage Dietetics and Nutrition Faculty Content Validity Email.....	30
Appendix C - Content Validity and Pilot Study Evaluation Questions.....	31
Appendix D - UAA Dietetics and Nutrition (DN) Graduate Students Face Validity Email.....	33
Appendix E - Survey of Future Graduate Students' Knowledge, Attitudes, and Behaviors Regarding Microplastics.....	34
Appendix F - Initial and Follow-up Recruitment Email to Program Directors.....	39
Appendix G - Initial and Follow-up Recruitment Email to Potentially Eligible Participants.....	42
Appendix H - Cover Letter to Potential Participants.....	45
Appendix I - Informed Consent.....	47
Appendix J - Random Drawing for Incentive.....	49

Introduction

The world is filled with plastic and as the world demands more convenience and more cost reduction, businesses will continue to produce and use plastic, buyers will continue to purchase it, and landfills will continue to accumulate plastic. This material is desirable because of its low cost, durability, and adaptability. The demand for plastic is increasing annually.¹ In 2018, the United States alone generated 35.7 million tons of plastic and 27 million tons ended up in landfills.² Worldwide plastic production in 2017 was 348 million tons and 50% of plastics were made into single-use products.^{2,3} Many products that are used in daily life are easily identified as plastic, such as plastic utensils and plastic cups.² However, there are other plastics that individuals may be less familiar with, such as disposable diapers or plastics in clothes.⁴ There are procedures, such as recycling, in place to reuse plastic, which also further encourages mass production. People are sometimes more inclined to purchase products that use plastic because they believe they can recycle, but this is not always the case.⁵

Due to the continued mass production of plastics, microplastics are now a cause for concern. The term microplastics is defined by National Geographic as “tiny plastic particles that result from both commercial product development and the breakdown of larger plastics”.⁶ Increased awareness of microplastics is critical as they have recently been found in human blood, lungs and stool.^{7,8,9} If people continue to purchase plastics, more plastic will be produced, and the number of microplastics in the environment will increase.²

Many effects of microplastics on life forms and the environment are unclear and more research is needed. Although most individuals are aware of the accumulation of large plastics in the environment, many are ignorant of the potential health and environmental problems of

microplastics.⁸ Although plastic is convenient, it takes more than a human lifetime to break down into microplastics. The lifecycle of some plastic products can be over 100 years.⁵

More research is needed on the health impacts of consuming microplastics and also to understand the behavior, awareness, and willingness of people to change their dependence on plastic.^{7,8} Health care providers can have an impact through their ability to influence policies and raise awareness of the accumulation of plastic and offer ways to limit the use of plastic.¹⁰

Registered dietitian nutritionists (RDNs) are essential in this effort due to their role in educating consumers about sustainable food systems. For example, RDNs can encourage individuals to shop at local food markets, use reusable shopping bags, bring reusable containers to restaurants, and use reusable water bottles, all of which will reduce the amount of plastic being wasted or degraded to microplastics.¹¹ However, there is currently a lack of research on what future RDNs know about microplastics or how their knowledge is related to attitudes and behaviors on the topic of microplastics. Therefore, a baseline understanding of the knowledge, attitudes, and behaviors of nutrition and dietetics students regarding microplastics is critical to adequately prepare future RDNs for their role in supporting sustainable food systems. A sustainable food system is defined as having four interconnected domains: nutrition and health; environmental stewardship; economic vitality; and social, cultural, and ethical capital.¹²

Literature Review

Plastic production began in the United Kingdom in the 1950s and has spread across the globe.¹³ In 2018, 359 million tons of plastic were produced worldwide.⁴ Plastics are considered microplastics when they are < 5mm, the size of one-half of a Skittle®, that have either broken

down from bigger products or are produced to be small such as in facial cleansers or water bottles.^{4,7,8,14}

Due to their small volume and large surface area, microplastics can easily absorb pollutants and pathogens (i.e., *Vibrio spp.*, *Escherichia coli*, *Stenotrophomonas maltophilia*, *Bacillus cereus*, and *Aeromonas salmonicida*). Some plastics are considered more dangerous due to the chemicals that they contain, which can easily contaminate the environment, fish, beer, tap and bottled water, and humans.¹⁵ Due to microplastics' small volume and large surface area, some microplastics have the ability to absorb easier.⁴ For example, polyethylene is a type of plastic that can absorb four times more contaminants than polypropylene plastic.¹⁶ The plastics mentioned previously are commonly found in milk jugs and trash bags.¹⁷

Due to the chemicals contained in plastics and the ease by which some plastics absorb contaminants, there are concerns about how microplastics affect the environment and food safety. Microplastics are consumed by marine life and at least 17% of society relies on seafood.⁴ Polyethylene and polypropylene wash up on shores around the world because it is the 1% of plastic that floats. The other 99% of plastics sink, due to their density, which is why bottom feeders such as shrimp, are more prone to consuming microplastics and other pollutants. The environmental risk of plastics is still unknown in the world.¹⁴

Like marine life, humans also ingest microplastics. Research has indicated that microplastics are not only found in human lungs, but also in the bloodstream.^{6,7} Additionally, research has found a correlation between the presence of microplastics in uterine fibroids and also in altered gene expression.^{18,19} Plastics, such as polyester and polystyrene, both commonly used in many items, are known to cause health complications such as cancer. Microplastics may affect how humans absorb nutrients.¹⁴

Because there is growing evidence about the impact of plastics on the environment and on human health, registered dietitian nutritionists (RDNs) should recognize their important role in supporting sustainable food systems and be knowledgeable about microplastics. RDNs can evaluate food policies and address food system issues such as the health of the food environment and corresponding legislation.^{11,12} RDNs encourage healthy eating habits to decrease the chances of developing chronic diseases; however their recommendations need to consider the entire food system, not just single foods. For example, RDNs encourage fish and seafood consumption of at least eight ounces a week.²⁰ Individuals that consume shrimp are estimated to ingest 175 microplastic particles per year in European countries. Countries that consume more seafood, such as European countries, consume 11,000 microplastic particles per year per person.¹⁵ RDNs need to be aware of the potential exposure to microplastics when considering their recommendations to consumers.

In the Accreditation Council for Education in Nutrition and Dietetics (ACEND) accredited dietetics education programs, there is an emerging focus on sustainable food systems.²¹ A 2021 survey of dietetic interns found that 68% wanted more education on sustainable food systems and training due to a feeling of inadequate knowledge on this topic.¹² ACEND Graduate Program in Nutrition and Dietetics, Future Education Model (GP) standards specify required competencies in sustainable food systems more clearly than Dietetic Internship standards. No published research has investigated GP student knowledge, attitudes, and behaviors on the subject of microplastics. GPs, as an ACEND program format, have been in existence for only five years. Currently, the ACEND accreditation standards contain required curriculum on topics such as sustainability and agriculture, including the overall food system, as this topic is essential to the RDN position as a food and nutrition expert.²¹ If RDNs educate

consumers on specific plastic-reducing practices, such as using cardboard packaging instead of plastic packaging for fruits and vegetables, and advocate for policy change, then it is possible to make a considerable impact on consumers' exposure to microplastics. This study will provide baseline information about GP students' knowledge, attitudes, and behaviors regarding microplastics. GP students will soon be RDNs and are well positioned as food system change agents.

Research Question

What are the knowledge, attitudes, and behaviors on the subject of microplastics among students in the Graduate Program in Nutrition and Dietetics, Future Education Model (GP)?

Research Goal and Objective

Goal: Document the baseline of knowledge, attitudes, and behaviors on the subject of microplastics among students in the Graduate Program in Nutrition and Dietetics, Future Education Model (GP) as a basis for future educational interventions.

Objective: Complete an assessment of Graduate Program in Nutrition and Dietetics, Future Education Model (GP) students' knowledge, attitudes, and behaviors on the subject of microplastics.

Methods

For this cross-sectional study, an online survey was used to investigate Graduate Program in Nutrition and Dietetics, Future Education Model (GP) students' knowledge, attitudes, and behaviors on the subject of microplastics. The questions were based on existing surveys^{22,23} and

further developed to be used to research microplastics awareness among GP students in the United States (Appendix A). Prior to submission to the University of Alaska Anchorage (UAA) Institutional Review Board (IRB), a content validity process was completed by the UAA Dietetics and Nutrition (DN) faculty and UAA Biology faculty members (Appendices B & C). Following the review and approval of the research proposal and the survey instrument by the UAA IRB, a face validity process was conducted with graduate DN students and dietetic interns attending UAA (Appendix D). Inclusion criteria for the survey were enrollment in a GP in Nutrition and Dietetics, Future Education Model in the United States, and being over the age of 18. The exclusion criteria were undergraduate students, dietetic interns, UAA GP students, and alumni.

Qualtrics was used as the online survey dissemination tool. The eligibility screening questions appeared before the survey questions. The survey (Appendix E) had 22 questions that asked participants about their knowledge, attitude, and behavior regarding microplastics and included single-choice, multiple choice, and Likert scale questions. The questions were divided into four sections: demographics, knowledge, attitudes, and behaviors. The first section asked for demographic information (age, geographic location, environment, and gender identity) of the GP student. The second section investigated the respondents' knowledge of microplastics and where microplastics could be found. If students reported that they had no knowledge of microplastics, then skip logic was used to move them into the next section, attitudes. The third section asked questions about GP students' attitudes towards microplastics. The fourth section describes students' current behaviors and practices to microplastics.

A list of GP program director emails was collected from the Accreditation Council for Education in Nutrition and Dietetics (ACEND) website. An invitation with an electronic link to

the Qualtrics survey was sent via email to the ACEND GP directors and they were asked to forward the email to their GP students. Program directors were contacted via email three times (Appendix F-I). The first email introduced the survey, with two follow-up reminders sent a week apart. Program directors that responded to the Principal Investigator (PI) stating that they had sent the email out to the students stopped receiving reminders. Students who completed the full survey were invited to enter a random drawing to win one of four Amazon.com gift cards worth \$25 each (Appendix J). A graduate student who was not involved with this study conducted the random drawing to ensure confidentiality. The non-affiliated graduate student completed the electronic raffle by creating an Excel spreadsheet with the emails of subjects who wanted to participate in the drawing. Random.org was used to select the winners

Analysis

The Statistical Package for the Social Sciences (SPSS) was used for data management and analysis.²⁴ A codebook was developed and used to guide the data analysis. The results of the survey are presented descriptively (means and standard deviations for continuous variables; frequencies and percentages for categorical variables).

Results

In December 2021, there were 892 Graduate Program (GP) students enrolled in the Accreditation Council for Education in Nutrition and Dietetics (ACEND) accredited programs, according to the program directors' annual report data.²⁵ There were 56 program directors who received recruitment emails and 39 students accessed the survey. Thirty GP students completed the full survey, resulting in a response rate of 3.4%. The mean age of the sample was 25 years old (S.D. \pm 4.7) (Table 1). Participants lived in all four regions of the United States. Most

participants identified as female ($n = 27$, 90.0%) and lived in an inland environment ($n = 24$, 80.0%).

Table 1. Participants Demographics

Demographic Data	Mean +/- Standard Deviation
Age (y)	25.0 \pm 4.7
	<i>n</i> (%)
State participants lived in	
Arizona	2 (6.7%)
California	2 (6.7%)
Florida	1 (3.3%)
Maryland	1 (3.3%)
Nebraska	1 (3.3%)
New Jersey	6 (20.0%)
New Mexico	1 (3.3%)
New York	4 (14.3%)
North Carolina	2 (6.7%)
Ohio	1 (3.3%)
Pennsylvania	3 (10.0%)
Rhode Island	1 (3.3%)
Tennessee	2 (6.7%)
Texas	2 (6.7%)
Wisconsin	1 (3.3%)
Environment participant lives in	
Coastal	6 (20.0%)
Inland	24 (80.0%)
Gender identity	
Male	2 (6.7%)
Female	27 (90.0%)
Non-binary	1 (3.3%)
Other	0 (0.0%)
Prefer not to answer	0 (0.0%)

Five participants (16.7%) reported that they had not heard of microplastics before. The 25 participants who had previously heard of microplastics selected oceans, landfills, and aquatic life as places where microplastics could be found and only 15 students (60.0%) selected the atmosphere as a place where environmental microplastics could be found. The majority of students correctly selected food packages ($n = 24$, 96.0%), water bottles ($n = 23$, 92.0%), and food ($n = 22$, 88.0%) as the other items where microplastics can be found. Clear plastic packaging, disposable plastic shopping bags, plastic toys, and plastic utensils were selected by all

participants when asked what creates microplastics and the majority of students also selected drink bottles (n = 24, 96.0%) and tires (n = 22, 88.0%). All participants agreed that people unknowingly ingest microplastics. The majority also stated that people inhale microplastics without knowing (n = 22, 88.0%) (Table 2).

Table 2. Reported Knowledge on Microplastics

	<i>n (%)</i>
Participants heard of microplastics	
Yes	25 (83.3%)
No	5 (16.7%) ^a
Environments microplastics can be found	
Oceans	25 (100.0%)
Landfill	25 (100.0%)
Aquatic life	25 (100.0%)
Rivers	24 (96.0%)
Humans	23 (92.0%)
Soil	23 (92.0%)
Wildlife	21 (84.0%)
Glaciers	17 (68.0%)
Atmosphere	15 (60.0%)
Other items microplastics can be found in	
Food packages	24 (96.0%)
Water bottles	23 (92.0%)
Food	22 (88.0%)
Tap water	19 (76.0%)
Beer	13 (52.0%)
Objects that create microplastics	
Clear plastic packaging	25 (100.0%)
Disposable plastic shopping bags	25 (100.0%)
Plastic toys	25 (100.0%)
Plastic utensils	25 (100.0%)
Drink bottles	24 (96.0%)
Tires	22 (88.0%)
Beauty cleansers	19 (76.0%)
Disposable diapers	18 (72.0%)
Clothes	16 (64.0%)
Cigarettes	10 (40.0%)

Table 2. Reported Knowledge on Microplastics (continued)

	<i>n</i> (%)
People ingest microplastics without knowing	
True	25 (100.0%)
False	0 (0.00%)
People inhale microplastics without knowing	
True	22 (88.0%)
False	3 (12.0%)

^aThe participants that indicated they had not heard of microplastics force skipped the rest of the knowledge questions, thus the maximum number of responses is 25 for the remainder of the table.

Most participants reported that plastic waste should be recycled (strongly agree: $n = 24$, 80.0%; agree: $n = 5$, 16.7%). When asked if they were knowledgeable about microplastics, one-third of the participants disagreed (disagree: $n = 7$, 23.3%; strongly disagree: $n = 3$, 10.0%), and one-third agreed ($n = 10$, 33.3%), whereas the remaining respondents were neutral. The majority of participants strongly agreed that microplastics have a negative impact on human health ($n = 16$, 53.3%). In terms of microplastics and concern about the effect on their own personal health, the majority of students either strongly agreed ($n = 6$, 20.0%) or agreed ($n = 14$, 46.7%) that it was a concern. Most students reported that recycling has a positive impact on the environment (strongly agree: $n = 15$, 50.0%; agree: $n = 10$, 33.3%). Lastly, the majority of students reported that they were concerned with the amount of packaging on food (strongly agree: $n = 14$, 46.7%; agree: $n = 11$, 36.7%) (Table 3).

Table 3. Reported Participant Attitude on Microplastics

	<i>n (%)</i>
Plastic waste should be recycled	
Strongly disagree	1 (3.3%)
Disagree	0 (0.0%)
Neutral	0 (0.0%)
Agree	5 (16.7%)
Strongly agree	24 (80.0%)
I am knowledgeable about microplastics	
Strongly disagree	3 (10.0%)
Disagree	7 (23.3%)
Neutral	9 (30.0%)
Agree	10 (33.3%)
Strongly agree	0 (0.0%) ^a
Microplastics have a negative impact on human health	
Strongly disagree	1 (3.3%)
Disagree	1 (3.3%)
Neutral	4 (13.3%)
Agree	8 (26.7%)
Strongly agree	16 (53.3%)
I am concerned about the effect of microplastics on my health	
Strongly disagree	0 (0.0%)
Disagree	0 (0.0%)
Neutral	10 (33.3%)
Agree	14 (46.7%)
Strongly agree	6 (20.0%)
I am concerned about the effect of microplastics on the environment	
Strongly disagree	0 (0.0%)
Disagree	0 (0.0%)
Neutral	4 (13.3%)
Agree	12 (40.0%)
Strongly agree	14 (46.7%)
Recycling has a positive impact on the environment	
Strongly disagree	0 (0.0%)
Disagree	1 (3.3%)
Neutral	4 (13.3%)
Agree	10 (33.3%)
Strongly agree	15 (50.0%)
I am concerned about the amount of packaging on the food I purchase	
Strongly disagree	0 (0.0%)
Disagree	1 (3.3%)
Neutral	4 (13.3%)
Agree	11 (36.7%)
Strongly agree	14 (46.7%)

^a 1 Participant did not answer.

The majority of participants reported that they recycled plastic bottles, bags, cups (all of the time: n = 12, 40%; often: n = 13, 43.3%); glass jars and bottles, any color (all of the time: n = 12, 40.0%; often: n = 11, 36.7%); aluminum and tin cans (all of the time: n = 15, 50.0%; often: n = 9, 30.0%); cardboard (all of the time: n = 18, 60.0%; often: n = 6, 20.0%); paper and newspaper (all of the time: n = 13, 43.3%; often: n = 12, 40.0%); and metal (all of the time: n = 6, 20.0%; often: n = 9, 30.0%). Almost all of the students reported that recycling was available in their communities (all of the time: n = 10, 33.3%; often: n = 12, 40.0%); in stores (all of the time n = 5, 16.7%; often: n = 8, 26.7%); in students' schools (all of the time: n = 8, 26.7%; often: n = 12, 40.0%); and sometimes available in community parks (n = 11, 36.7%; neutral: n = 7, 23.3%) (Table 4).

Participants ate food prepared away from home in disposable materials sometimes (n = 12, 40.0%) or often (n = 9, 30.0%). Almost half of the students stated that they used disposable dining and food storage products (i.e., plastic utensils, paper coffee cups) sometimes (n = 12, 40.0%). A majority of students sometimes washed their clothes after a single use (n = 17, 56.7%). Almost half of the participants (n = 14, 46.7%) reported that they did not reheat food in a microwave using a plastic container. Some reported that they consumed fish on a weekly basis (n = 16, 53.3%) and shrimp on a monthly basis (n = 10, 33.3%), while others reported consuming no fish (n = 12, 40.0%). Participants responded that they consumed other shellfish on a monthly basis (n = 12, 40.0%) or none (n = 16, 53.3%); other seafood on a monthly basis (n = 13, 43.3%) or none (n = 14, 46.7%); red meat on a monthly basis (n = 12, 40.0%); and poultry on a weekly basis (n = 14, 46.7%) (Table 4).

Table 4. Reported Participant Behaviors on Microplastic

	<i>n (%)</i>
I recycle plastic bottles, bags, cups	
None of the time	1 (3.3%)
Sometimes	4 (13.3%)
Neutral	0 (0.0%)
Often	13 (43.3%)
All of the time	12 (40.0%)
I recycle glass jars and bottles, any color	
None of the time	1 (3.3%)
Sometimes	6 (20.0%)
Neutral	0 (0.0%)
Often	11 (36.7%)
All of the time	12 (40.0%)
I recycle aluminum and tin cans	
None of the time	2 (6.7%)
Sometimes	4 (13.3%)
Neutral	0 (0.0%)
Often	9 (30.0%)
All of the time	15 (50.0%)
I recycle cardboard	
None of the time	0 (0.0%)
Sometimes	5 (16.7%)
Neutral	1 (3.3%)
Often	6 (20.0%)
All of the time	18 (60.0%)
I recycle paper and newspaper	
None of the time	0 (0.0%)
Sometimes	3 (10.0%)
Neutral	2 (6.7%)
Often	12 (40.0%)
All of the time	13 (43.3%)
I recycle metal	
None of the time	4 (13.3%)
Sometimes	6 (20.0%)
Neutral	5 (16.7%)
Often	9 (30.0%)
All of the time	6 (20.0%)
Recycling is available in my community	
None of the time	2 (6.7%)
Sometimes	4 (13.3%)
Neutral	2 (6.7%)
Often	12 (40.0%)
All of the time	10 (33.3%)

Table 4. Reported Participant Behaviors on Microplastics (continued)

	<i>n (%)</i>
Recycling is available in my stores	
None of the time	2 (6.7%)
Sometimes	10 (33.3%)
Neutral	5 (16.7%)
Often	8 (26.7%)
All of the time	5 (16.7%)
Recycling is available in my schools	
None of the time	2 (6.7%)
Sometimes	7 (23.3%)
Neutral	1 (3.3%)
Often	12 (40.0%)
All of the time	8 (26.7%)
Recycling is available in my community in parks	
None of the time	3 (10.0%)
Sometimes	11 (36.7%)
Neutral	7 (23.3%)
Often	7 (23.3%)
All of the time	2 (6.7%)
I eat food prepared away from home that is packaged in disposable materials	
None of the time	3 (10.0%)
Sometimes	12 (40.0%)
Neutral	5 (16.7%)
Often	9 (30.0%)
All of the time	1 (3.3%)
I use disposable dining and food storage products (i.e., plastic utensils, paper coffee cups, plastic water bottles or cups, plastic plates, plastic wrap, plastic straws, plastic bags, etc.)	
None of the time	5 (16.7%)
Sometimes	12 (40.0%)
Neutral	3 (10.0%)
Often	8 (26.7%)
All of the time	2 (6.7%)
I wash my clothes after one use	
None of the time	3 (10.0%)
Sometimes	17 (56.7%)
Neutral	3 (10.0%)
Often	5 (16.7%)
All of the time	2 (6.7%)

Table 4. Reported Participant Behaviors on Microplastics (continued)

	<i>n (%)</i>
I use plastic dishes or containers in a microwave to reheat food	
None of the time	14 (46.7%)
Sometimes	6 (20.0%)
Neutral	1 (3.3%)
Often	8 (26.7%)
All of the time	1 (3.3%)
Select if you consume, and how often you consume the following:	
Fish	
Multiple times daily	0 (0.0%)
Daily	2 (6.7%)
Weekly	16 (53.3%)
Monthly	7 (23.3%)
None	5 (16.7%)
Shrimp	
Multiple times daily	0 (0.0%)
Daily	0 (0.0%)
Weekly	8 (26.7%)
Monthly	10 (33.3%)
None	12 (40.0%)
Other shellfish	
Multiple times daily	0 (0.0%)
Daily	0 (0.0%)
Weekly	2 (6.7%)
Monthly	12 (40.0%)
None	16 (53.3%)
Other seafood	
Multiple times daily	0 (0.0%)
Daily	0 (0.0%)
Weekly	3 (10.0%)
Monthly	13 (43.3%)
None	14 (46.7%)
Red meat	
Multiple times daily	0 (0.0%)
Daily	0 (0.0%)
Weekly	9 (30.0%)
Monthly	12 (40.0%)
None	9 (30.0%)

Table 4. Reported Participant Behaviors on Microplastics (continued)

	<i>n (%)</i>
Poultry products	
Multiple times daily	1 (3.3%)
Daily	11 (36.7%)
Weekly	14 (46.7%)
Monthly	0 (0.0%)
None	4 (13.3%)

Discussion

According to the Accreditation Council for Education in Nutrition and Dietetics Education Program Statistics, there are high rates of white females in the program. The gender identity statistics in 2021 showed Female (60%, $n = 15,593$), Male (12%, $n = 2,190$) and Other/Non-Binary ($n = 118$). This confirms that the demographics of this study sample aligned with the ACEND reported demographics.²⁶

The majority of the respondents had heard of microplastics. This result was unexpected as a 2020 study conducted in Shanghai found that only 26% ($n = 113$) of participants had heard of microplastics. Although the Shanghai study was conducted with the public and 61% ($n = 267$) reported having a college degree or higher education, it was assumed that this study would have a similar finding.⁴ Further research could verify if this study's results actually represents the majority of Graduate Program in Nutrition and Dietetics, Future Education Model (GP) students.

Although almost all participants had heard of microplastics, the impact of this awareness was not consistently reflected in their reported knowledge, attitudes, and behaviors. One example of inconsistency about reported knowledge was the questions about microplastics in the atmosphere and whether individuals inhale microplastics.⁸ While the majority of participants selected that people inhale microplastics, many students did not select that microplastics are present in the atmosphere. This could be due to a wording choice limitation in the survey answer options that included atmosphere instead of air. Microplastics are indeed inhaled. A study found

evidence of microplastic particles in the subjects' lungs. Although the study was small, 85% (n = 11) of the participants had microplastic fragments inside their lungs.⁸

All participants who completed the knowledge section of the survey selected that people ingest microplastics without knowing. However, not all students selected that microplastics can be found in frequently consumed items or in the human body. Although there is a gap in research on microplastics and their effects on the human body, it is worthwhile to note that participants reported an impact on human health. Not all participants were strongly concerned about their own health regarding microplastics being in the human body, possibly due to the lack of research showing known harm from microplastics. Recent research found that 77% (n = 17) of participants had microplastics in their blood, however the health impacts of this finding are still unknown.⁷

The majority of the participating students reported that they were concerned with the packaging of food and agreed that plastic should be recycled. Nevertheless, the participants' reported behaviors regarding recycling did not reflect this concern. It is unclear as to why the participating students responded this way and whether these findings are related to community access to recycling, prohibitive costs associated with recycling, or their own personal beliefs of recycling as a system. Recycling is a commonly known procedure to reuse or reduce plastic waste. However, not all plastic can be or is recycled. Additionally, many participants reported that recycling was accessible in their communities.² Further research is needed to explore reasons why recycling is or is not consistently used by GP students, and about their attitudes and behaviors towards plastic.

Despite the participating students being aware of microplastics and their potential harms, many reported eating food prepared away from home in disposable packaging and using

disposable dining products (i.e., plastic utensils, plastic water bottles, etc.). Additionally, over half of the participants reported washing their clothes after one use, which is a known contributor to microplastic creation.⁴ A cause for concern is that the majority of the participating students reported microwaving food within a plastic product.¹⁷ Our food can also be contaminated with microplastics when it is microwaved in plastic containers. With further education, we may be able to control microplastic ingest through reheating food in plastic containers.

Despite participants' knowledge of potential microplastic sources, they reported consuming seafood on a regular basis. The Food and Drug Administration (FDA) recommends that the public consume eight ounces of fish per week, thus promoting the health benefits of seafood.²¹ Some plastics pose more of a threat than others, due to their ability to absorb more contaminants, such as chemicals and pathogens.^{14, 15, 16} Additionally, water and fish are well known for being contaminated by microplastics.¹⁶ However, research is currently inadequate to guide nutrition and health recommendations.

Registered dietitian nutritionists (RDNs) educate the public on sustainable diets and different ways to keep their bodies and the planet healthy. RDNs can have a big impact on policies that influence change in benefitting our planet. Additionally, Standards of Professional Performance support the role of RDNs in building and maintaining sustainable food systems.²⁰ It is unclear what barriers are preventing GP students, as future RDNs, from practicing habits to reduce microplastic accumulation. Further research needs to explore the understanding and behaviors of GP students' involvement in sustainable food systems.

The inconsistency of what is taught in higher education about environmentally friendly behaviors versus what is practiced within student populations is not limited to microplastics. One study examined undergraduate student perceptions of climate-friendly actions, such as recycling,

reduced plastic use, and reduced red meat intake. Most participants selected that consuming less red meat is not as effective as other forms of climate change behaviors. However, it is known that red meat production does increase environmental impact.²⁷ This study suggested that individuals need more awareness of the environmental impact of the high rates of greenhouse gasses released due to the production of red meat, thus reinforcing the need for more education about environmentally friendly behaviors, overall.²⁷

Small plastic particles were first reported in 1970, however the term microplastic was first documented in 2004 and in recent years they have attracted the interest of researchers.²⁸ Research has found that we excrete about 90% of microplastics while the other 10% stays in our body. Nanoplastics (smaller form of microplastics) have been shown to cause cardiopulmonary responses, alterations of endogenous metabolites, genotoxicity, inflammatory responses, oxidative stress, altered nutrient absorption, gut microflora, and reproduction complications.²⁹ Additionally, polypropylene microplastics could increase the release of cytokines and histamines in the body.³⁰ It is likely that the research deficit, awareness, and understanding of microplastics harm will be the greatest barrier to educating students and consumers about microplastics and guiding them toward behavior change. The small sample in the current study highlights inconsistencies in knowledge, attitudes, and behaviors in GP students towards microplastics, and indicates the need for further research to determine the best educational intervention. The topic of microplastics must be included in education on sustainable food systems, particularly for entry-level RDNs.

Strengths and Limitations

There is no known previous study on GP students and their knowledge, attitudes, and behaviors in regards to microplastics. The results of this survey provide a baseline of GP

students' knowledge, attitudes, and behaviors on the subject. The other strengths of this project include the processes used to establish the initial content and face validity for the survey tool. This study also addresses a topic that is timely and important for GP students.

The limitations of this project included that students were only reached by emailing the ACEND accredited GP program directors and requesting that they forward the email on to the students. Low response rates were likely a result of program directors sending out the email rather than students receiving the email directly from the PI. Per Dillman survey response rates, it's common for a response rate of 50-70% for a public survey.³¹ The generalizability of the results of this study is limited due to the low response rate. There is a selection bias in this survey because subjects may only have participated because they were interested in the topic. Interpretation of the results is limited due to the lack of published literature on how or if microplastics have an effect on the human body and the effects microplastics have on the environment. One survey question became a limitation because air and atmosphere are interchangeable words in conversation, however, they have different definitions. The word "air" may have been a more appropriate word to include in the survey.

Conclusions

Due to the low response rate, the results of this study cannot be generalized to describe all GP students' knowledge, attitudes, and behaviors regarding microplastics. ACEND accredited programs should consider adding education about microplastics to their curriculum. Students could be more aware of sources of microplastics, rates of annual plastic production, and ways to reduce plastic waste. Students in GPs will soon become health professionals who influence policies and educate the public. As many participants did not connect related information in the

survey, it is clear that more education about microplastics is needed within education on sustainable food systems.

Dietetics and Nutrition Practice Implications

This study improved awareness of microplastics among participants, who may be inspired to do further research after participating in the survey. The dissemination of the results of this survey, through an abstract and poster session at the 2023 Food and Nutrition Conference and Exhibition, can inform updates to ACEND education requirements. There are limited surveys on knowledge, attitudes, and behaviors regarding microplastics in any population. This survey could be used in other groups (i.e., parents, health professionals, or coffee consumers) to investigate their knowledge, attitudes, and behaviors on the subject of microplastics. The project contributes to the microplastic knowledge base and can further research on health care professional students' knowledge, attitudes and behaviors regarding microplastics as an outcome measure of the adequacy of entry-level education on sustainable food systems.

References

1. Vollmer I, Jenks MJF, Roelands MCP, et al. Beyond mechanical recycling: Giving new life to plastic waste. *Angewandte Chemie (International ed.)*. 2020;59(36):15402-15423.
2. Environmental Protection Agency. (n.d.). EPA: National overview: facts and figures on materials, wastes, and recycling. Retrieved January 19, 2023, from <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials>.
3. He P, Chen L, Shao L, Zhang H, Lü F. Municipal solid waste (MSW) landfill: A source of microplastics? -evidence of microplastics in landfill leachate. *Water Res*. 2019;159:38-45. <https://www-sciencedirect-com.proxy.consortiumlibrary.org/science/article/pii/S004313541930377X>. doi: <https://doi-org.proxy.consortiumlibrary.org/10.1016/j.watres.2019.04.060>.
4. Deng L, Cai L, Sun F, Li G, Che Y. Public attitudes towards microplastics: Perceptions, behaviors and policy implications. *Resour Conserv Recycling*. 2020;163:105096. <https://www-sciencedirect-com.proxy.consortiumlibrary.org/science/article/pii/S0921344920304134>. doi: <https://doi-org.proxy.consortiumlibrary.org/10.1016/j.resconrec.2020.105096>.
5. World Wildlife Fund. (n.d.). Endangered species conservation. WWF. Retrieved March 13, 2022, from https://www.worldwildlife.org/?utm_campaign=301-redirects&utm_source=wwf.org&utm_medium=referral&utm_content=wwf.org.
6. *Microplastics*. National Geographic Society. (n.d.). Retrieved January 17, 2023, from <https://education.nationalgeographic.org/resource/microplastics>.
7. Leslie HA, van Velzen, Martin J. M., Brandsma SH, Vethaak AD, Garcia-Vallejo JJ, Lamoree MH. Discovery and quantification of plastic particle pollution in human blood. *Environ Int*. 2022;107199. <https://www.sciencedirect.com/science/article/pii/S0160412022001258>. doi: <https://doi.org/10.1016/j.envint.2022.107199>.
8. Jenner LC, Rotchell JM, Bennett RT, Cowen M, Tentzeris V, Sadofsky LR. Detection of microplastics in human lung tissue using μ FTIR spectroscopy. *Sci Total Environ*. 2022;831:154907. <https://www.sciencedirect.com/science/article/pii/S0048969722020009>. doi: <https://doi.org/10.1016/j.scitotenv.2022.154907>.
9. Schwabl P, Köppel S, Königshofer P, et al. Detection of various microplastics in human stool. *Ann Intern Med*. 2019;171(7):453-457. <https://doi.org/10.7326/M19-0618>. doi: 10.7326/M19-0618.
10. Centers for Disease Control and Prevention. (2022, March 15). *CDC policy process*. Centers for Disease Control and Prevention. Retrieved January 17, 2023, from <https://www.cdc.gov/policy/opaph/process/index.html>.

11. Wegener J. Equipping future generations of registered dietitian nutritionists and public health nutritionists: A commentary on education and training needs to promote sustainable food systems and practices in the 21st century. *Journal of the Academy of Nutrition and Dietetics*. 2018;118(3):393-398. <https://www-sciencedirect-com.proxy.consortiumlibrary.org/science/article/pii/S2212267217317380>. doi: <https://doi-org.proxy.consortiumlibrary.org/10.1016/j.jand.2017.10.024>.
12. Hege A, Giddens J, Bergquist E, et al. Integration of a sustainable food systems curriculum in nutrition and dietetics education: Assessment from the first year of implementation. *Journal of the Academy of Nutrition and Dietetics*. 2021;121(12):2536-2548.
13. Plastics Industry Association. (n.d.). Retrieved March 13, 2022, from <https://www.plasticsindustry.org/>
14. Jaiswal KK, Dutta S, Banerjee I, et al. Impact of aquatic microplastics and nanoplastics pollution on ecological systems and sustainable remediation strategies of biodegradation and photodegradation. *Sci Total Environ*. 2021;151358. <https://www-sciencedirect-com.proxy.consortiumlibrary.org/science/article/pii/S0048969721064366>. doi: <https://doi-org.proxy.consortiumlibrary.org/10.1016/j.scitotenv.2021.151358>.
15. Barboza LGA, Dick Vethaak A, Lavorante, Beatriz R. B. O., Lundebye A, Guilhermino L. plastic debris: An emerging issue for food security, food safety and human health. *Mar Pollut Bull*. 2018;133:336-348. <https://www.sciencedirect.com/science/article/pii/S0025326X1830376X>. doi: <https://doi.org/10.1016/j.marpolbul.2018.05.047>.
16. Teuten EL, Saquing JM, Knappe DR, et al. Transport and release of chemicals from plastics to the environment and to wildlife. *Philos Trans R Soc Lond B Biol Sci*. 2009;364(1526):2027-2045. doi:10.1098/rstb.2008.0284.
17. Vollmer I, Jenks MJF, Roelands MCP, et al. Beyond Mechanical Recycling: Giving New Life to Plastic Waste. *Angewandte Chemie (International ed.)*. 2020;59:15402-15423.
18. Lang , K. (n.d.). *Uterine fibroids: Chemicals in everyday plastics stimulate growth*. Medical News Today. Retrieved January 24, 2023, from https://www.medicalnewstoday.com/articles/how-phthalates-accelerate-the-growth-of-uterine-fibroids?fbclid=IwAR2Iqf8Es6EQ6zC2UkVYgH-6gpAzFmI44_vdFLuH91ruGz1iEXfUZM-DNRg.
19. Zurier HS, Goddard JM. Biodegradation of microplastics in food and agriculture. *Current Opinion in Food Science*. 2021;37:37-44.

<https://www.sciencedirect.com/science/article/pii/S2214799320300680>. doi: 10.1016/j.cofs.2020.09.001.

20. Center for Food Safety and Applied Nutrition. *Advice about eating fish*. U.S. Food and Drug Administration. <https://www.fda.gov/food/consumers/advice-about-eating-fish>. Accessed April 18, 2022.

21. Accreditation Council for Education in Nutrition and Dietetics (ACEND). *ACEND Accreditation Standards for Nutrition and Dietetics Graduate Programs (GP) (Future Education Model)*. Adopted November 1, 2021; effective June 1, 2022. Available at: <https://www.eatrightpro.org/-/media/files/eatrightpro/acend/accreditation-standards-fees-and-policies/future-education-model-standard-and-templates-v2022/fem-graduate-reformat.pdf>.

22. Janoušková S, Teplý P, Fatka D, Teplá M, Cajthaml T, Hák T. *Microplastics—How and what do university students know about the emerging environmental sustainability issue? Sustainability*. 2020;12(21):9220. <https://proxy.consortiumlibrary.org/login?url=https://www.proquest.com/scholarly-journals/microplastics-how-what-do-university-students/docview/2548881694/se-2>. doi: <http://dx.doi.org/10.3390/su12219220>.

23. *Microplastics questionnaire - home - A rocha international*. (n.d.). Retrieved January 25, 2023, from <https://www.arocha.org/wp-content/uploads/2018/01/microplastics-questionnaire.pdf>.

24. SPSS statistics - overview. IBM. <https://www.ibm.com/products/spss-statistics>. Accessed April 18, 2022.

25. Accreditation Council for Education in Nutrition and Dietetics (ACEND). Enrollment by Program Type. 1995-2021 Program Enrollment Trends. December 2021. Accessed September 23, 2022. <https://www.eatrightpro.org/-/media/files/eatrightpro/acend/about-acend/acend-data/1995-2021-program-enrollment-trends.pdf>.

26. ACEND accreditation standards - Eatrightpro.org. <https://www.eatrightpro.org/-/media/files/eatrightpro/acend/accreditation-standards-fees-and-policies/2022-standards-and-templates/2022-accreditation-standards-for-nutrition-and-dietetics-internship-programs.pdf>. Accessed March 13, 2023.

27. Slotnick MJ, Falbe J, Cohen JFW, Gearhardt AN, Wolfson JA, Leung CW. Environmental and climate impact perceptions in university students: Sustainability motivations and perceptions correspond with lower red meat intake. *Journal of the Academy of Nutrition and Dietetics*. 2022.

28. Napper IE, Thompson RC. Plastic Debris in the Marine Environment: History and Future Challenges. *Glob Chall*. 2020;4(6):1900081. Published 2020 Apr 6. doi:10.1002/gch2.201900081.
29. Smith M, Love DC, Rochman CM, Neff RA. Microplastics in seafood and the implications for human health. *Current environmental health reports*. 2018;5:375-386.
30. Blackburn K, Green D. *The potential effects of microplastics on human health: What is known and what is unknown*. *Ambio*. 2022;51(3):518-530. doi:10.1007/s13280-021-01589-9
31. University of Washington. https://faculty.washington.edu/jelmore/articles_online/Dillman-Des%26Admin_Ma.pdf. Accessed March 13, 2023.

Appendix A - Original and Modified Survey Questions

Original Question	Altered Question	Citation
What is your age?	What is your age?	
Which state do you live in?	Which state do you live in?	
Please select gender	Please select gender	
Where in the environment could you find microplastics?	Where in the environment can you find microplastics?	<i>FapSustainability</i> . 2020;12(21):9220. https://proxy.consortiumlibrary.org/login?url=https://www.proquest.com/scholarly-journals/microplastics-how-what-do-university-students/docview/2548881694/se-2 . doi: http://dx.doi.org/10.3390/su12219220 .
Have you heard of microplastics?	Have you heard of microplastics?	GABBY
What are the sources of microplastics?	Which of these creates microplastics	Janoušková S, Teplý P, Fatka D, Teplá M, Cajthaml T, Hák T. Microplastics—How and what do university students know about the emerging environmental sustainability issue? <i>Sustainability</i> . 2020;12(21):9220. https://proxy.consortiumlibrary.org/login?url=https://www.proquest.com/scholarly-journals/microplastics-how-what-do-university-students/docview/2548881694/se-2 . doi: http://dx.doi.org/10.3390/su12219220 .
Recycling reduces the		GABBY

impact of microplastics?		
Do you think we consume microplastics?	Do you think we consume microplastics?	GABBY
How important is recycling to you?	How important is recycling to you?	GABBY
Do you participate in recycling?	How accessible is recycling in your community?	GABBY
How do you evaluate your knowledge about microplastics?	What is your level of knowledge about microplastics today?	https://www.arochoa.org/wp-content/uploads/2018/01/microplastics-questionnaire.pdf
Do you think microplastics have an impact on the health of the human population?	Do microplastics have an impact on the health of the human population?	https://www.arochoa.org/wp-content/uploads/2018/01/microplastics-questionnaire.pdf
How concerned are you about the problem of microplastics based on your current understanding?	How concerned are you about microplastics and your health?	https://www.arochoa.org/wp-content/uploads/2018/01/microplastics-questionnaire.pdf
How concerned are you about the problem of microplastics based on your current understanding?	How concerned are you about microplastics and your environment?	https://www.arochoa.org/wp-content/uploads/2018/01/microplastics-questionnaire.pdf

Do you believe your recycling can make an impact on the environment?		
How many times per week do you eat food prepared away from home that is packaged in disposable materials?	How many times per week do you eat food prepared away from home that is packaged in disposable materials?	GABBY
How often do you use disposable products daily in a week? Plastic utensils, coffee/redbull cup, water bottles, plastic plates, plastic wrapping	How often do you use disposable products daily in a week? (Plastic utensils, coffee/redbull cup, water bottles, plastic plates, plastic wrapping)	GABBY
How often do you wash your clothes?	How often do you wash your clothes?	GABBY
Do you consume shrimp?	Do you consume meat, seafood, or poultry products?	GABBY

Appendix B - University of Alaska Anchorage Dietetics and Nutrition Faculty Content Validity Email

Dear DN Faculty,

I am writing to you to request your participation in a content review process. You have been identified as a content expert in the dietetics and nutrition profession.

I am seeking your input on the survey tool for my graduate research project. I am researching the knowledge, attitudes, and Future Graduate (FG) students toward microplastics.

The content review process will involve the following steps:

1. Respond to this email that you are interested in participating in the content review process.
2. Review the survey tool.
3. Complete the questionnaire to provide feedback about the survey.

This link will take you to the survey tool and the questionnaire.
(insert link here)

I estimate that the content review process will take 30 minutes.

Completing the content review process will help me detect any unclear areas in the survey tool and provide content validity for my research.

If you have any questions about the content review process, please contact Dr. Carrie King or me.

The favor of your review is requested by (XXX).

Thank you very much for your consideration of my request to participate in this content review process.

Sincerely,
Gabrielle Arnes
gmblack@alaska.edu

Carrie King, PhD, RD, LD, CDCES
cdking@alaska.edu

Appendix C - Content Validity and Pilot Study Evaluation Questions

Directions: Please answer the following questions regarding the email invitation to the pilot study and the questionnaire that you just completed. Your suggestions will be used to revise the email and survey. Thank you for your time.

1. Was the email that invited you to participate in the study easy to understand and clear? If no, please explain.
 Yes
 No
Comments:
2. Did you feel that any of the items in the survey were confusing? If yes, please specify which ones.
 Yes
 No
Comments:
3. Do you think that any of the items in the survey lacked any response choices that would have been appropriate? If yes, please specify which ones.
 Yes
 No
Comments:
4. Did you think that the survey flowed in a logical order?
 Yes
 No
Comments:
5. How long did it take you to complete the survey?
6. Do you think that it took too long to complete the survey?
 Yes
 No
Comments:
7. Was there a question that you anticipated but was not asked?
8. How do you feel about the overall quality of the survey?
9. Was the survey visually appealing? If no, please explain.
 Yes
 No
Comments:
10. Please share any comments that we can use to improve the survey.

Directions: Please answer the following questions regarding the email invitation to the pilot study and the questionnaire that you just completed. Your suggestions will be used to revise the email and survey. Thank you for your time.

11. Was the email that invited you to participate in the study easy to understand and clear? If no, please explain.

- Yes
- No

Comments:

12. Did you feel that any of the items in the survey were confusing? If yes, please specify which ones.

- Yes
- No

Comments:

13. Do you think that any of the items in the survey lacked any response choices that would have been appropriate? If yes, please specify which ones.

- Yes
- No

Comments:

14. Did you think that the survey flowed in a logical order?

- Yes
- No

Comments:

15. How long did it take you to complete the survey?

16. Do you think that it took too long to complete the survey?

- Yes
- No

Comments:

17. Was there a question that you anticipated but was not asked?

18. How do you feel about the overall quality of the survey?

19. Was the survey visually appealing? If no, please explain.

- Yes
- No

Comments:

20. Please share any comments that we can use to improve the survey.

Appendix D - UAA Dietetics and Nutrition (DN) Graduate Students Face Validity Email

Dear UAA DN Graduate Students ,

I am writing to you to request your participation in a face validity review process.

I am seeking your input on the survey tool for my graduate research project. I am researching the knowledge, attitudes, and behaviors of toward microplastics

As a UAA DN graduate student, I am researching the knowledge, attitudes, and behaviors of dietetics and nutrition graduate students' in the United States towards microplastics.

The face validity process will involve the following steps:

1. Review the survey tool at this link: ###.
2. Complete the questionnaire on the last page of the survey in the above link.

I estimate that the face validity review process will take 20 – 30 minutes.

Completing the face validity review process will help me detect any unclear areas in the survey tool and establish initial face validity for my research.

If you have any questions about the content review process, please contact my graduate advisor Dr. Carrie King or me at the contact information listed below.

The favor of a reply is requested by [XXX], 2022.

Thank you very much for your consideration of our request to participate in this face validity review process.

Sincerely,
Gabrielle Arnes
gmblack@alaska.edu

Carrie King, PhD, RD, LD, CDCES
cdking@alaska.edu

Appendix E - Survey of Future Graduate Students' Knowledge, Attitudes, and Behaviors Regarding Microplastics

Screening for Eligibility Inclusion criteria:

1. Are you 18 years old or older?
 1. Yes
 2. No (forced quit)
2. Are you currently enrolled in an ACEND accredited Future Education Model Graduate program in the United States?
 1. Yes
 2. No (forced quit)

Demographics

1. What is your age?
 - Numeric response
2. Which state do you live in?
 - Drop down State menu
3. What type of environment do you live in?
 - Coastal
 - Inland
4. Do you think of yourself as:
 - Male/man
 - Female/woman

- Transgender male/man
- Transgender female/woman
- Non-binary
- Other
- Prefer not to answer

5. Have you heard of microplastics?

- Yes
- No (Skip Knowledge/Awareness)

Knowledge/Awareness

6. In which environments can microplastics be found? (Mark all that apply)

- Oceans
- Rivers
- Soil
- Glaciers
- Landfill
- Aquatic life
- Humans
- Wildlife
- Atmosphere

7. Where else can microplastics be found (Mark all that apply)

Beer

Tap Water

Water bottles

Food packages

Food

8. Which of these creates microplastics? (Mark all that apply)

- Beauty cleansers
- Disposable diapers
- Drink bottles
- Tires
- Plastic toys
- Plastic utensils
- Clothes
- Cigarettes
- Clear plastic packaging
- Disposable plastic shopping bags

9. Do people ingest or inhale microplastics without knowing?

- True/False

Attitude

Please indicate how much you agree with each of the following statements. Use a scale of 1 = strongly disagree, 5 = strongly agree.

10. Plastic waste should be recycled.
11. I am knowledgeable about microplastics.
12. Microplastics have a negative impact on human health.
13. I am concerned about the effect of microplastics on my own health.
14. I am NOT concerned about the effect of microplastics on the environment.
15. Recycling has a positive impact on the environment.
16. I am NOT concerned about the amount of packaging on the food I purchase.

Behavior

Please indicate how often you do complete each of the following things. Use a scale of 1 = none of the time, 5 = all of the time.

17. I recycle plastic bottles, bags, cups.
18. I NEVER recycle glass jars and bottles, any color.
19. I recycle aluminum and tin cans.
20. I NEVER recycle cardboard.
21. I recycle paper and newspaper.
22. I NEVER recycle metal.
23. Recycling is NOT available in my community.
24. Recycling is available in my stores
25. Recycling is available in my schools.

26. Recycling is available in my community in parks.

27. I pay a local company to recycle in my state.

28. I eat food prepared away from home that is packaged in disposable materials.

29. I use disposable dining and food storage products (i.e., plastic utensils, paper coffee cups, plastic water bottles or cups, plastic plates, plastic wrap, plastic straws, plastic bags, etc.)

30. I wash my clothes after one use.

31. I use plastic dishes or containers in a microwave to reheat food.

32. Select if you consume, and how often you consume the following: fish, shrimp, other shellfish, other seafood, red meat, or poultry products; how often?

- None
- Multiple times daily, daily, weekly, monthly (grid format will be used)

If you would like to participate in a random drawing to win one of four \$25 Amazon.com gift cards, select this link (####) to be taken to a new survey.

Appendix F - Initial and Follow-up Recruitment Email to Program Directors

Email subject line: Participate in a research study about microplastics

Dear Program Director,

My name is Gabrielle Arnes and I am a graduate student in the Future Education Model Graduate Program at the University of Alaska Anchorage. For my graduate project, I am studying Future Graduate students' knowledge, attitudes, and behaviors towards microplastics. This study has been approved by the University of Alaska Anchorage Institutional Review Board. Students who complete the full survey have the option to be entered into a random drawing to win one of four \$25 Amazon.com gift cards.

Would you be willing to assist me with the recruitment process by forwarding the attached invitation to you Future Graduate students?

Please feel free to contact me at gblack@alaska.edu or (907) 308-0102 if you have more questions or need more details on the project.

Sincerely,

Gabrielle M. Arnes,

Graduate Student

University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor

Carrie King, PhD, RD, LD, CDCES

Professor Dietetics and Nutrition

Director Dietetic Internship and Future Graduate Program

Email subject line: Participate in a research study about microplastics

Dear Program Director,

My name is Gabrielle Arnes and I am a graduate student in the Dietetics and Nutrition program at the University of Alaska Anchorage

I recently sent you a request asking you if you would be willing to assist me with a recruitment process by forwarding the attached invitation to your Future Graduate students. For my graduate project, I am studying Future Graduate students' knowledge, attitudes, and behaviors towards microplastics. This study has been approved by the University of Alaska Anchorage Institutional Review Board. Students who complete the full survey have the option to be entered into a random drawing to win one of four \$25 Amazon.com gift cards

Would you be willing to assist me a second time with the recruitment process by forwarding the attached invitation to you Future Graduate students?

Please feel free to contact me at gblack@alaska.edu or (907) 308-0102 if you have more questions or need more details on the project.

Sincerely,

Gabrielle M. Arnes,

Graduate Student

University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor

Carrie King, PhD, RD, LD, CDCES

Professor Dietetics and Nutrition

Director Dietetic Internship and Future Graduate Program

Email subject line: Participate in a research study about microplastics

Dear Program Director,

My name is Gabrielle Arnes and I am a graduate student in the Dietetics and Nutrition program at the University of Alaska Anchorage.

I recently sent you a request asking you if you would be willing to assist me with a recruitment process by forwarding the attached invitation to your Future Graduate students. For my graduate project, I am studying Future Graduate students' knowledge, attitudes, and behaviors towards microplastics. This study has been approved by the University of Alaska Anchorage Institutional Review Board. Students who complete the full survey have the option to be entered into a random drawing to win one of four \$25 Amazon.com gift cards

Would you be willing to assist me one last time with the recruitment process by forwarding the attached invitation to you Future Graduate students?

Please feel free to contact me at gblack@alaska.edu or (907) 308-0102 if you have more questions or need more details on the project.

Sincerely,

Gabrielle M. Arnes,
Graduate Student
University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor
Carrie King, PhD, RD, LD, CDCES
Professor Dietetics and Nutrition
Director Dietetic Internship and Future Graduate Program

Appendix G - Initial and Follow-Up Recruitment Email to Potentially Eligible Participants

Email subject line: Participate in a research study about microplastics to win one of four \$25

Amazon.com gift cards!

Dear Future Graduate students,

What an opportunity to:

Increase your knowledge of microplastics?

Participate in a study that uses on-line learning?

Be entered in a drawing for a chance to win one of four \$25 Amazon.com gift card

If you're a Future Education Model Graduate Programs (FG) currently enrolled in an ACEND program, click the link below (insert link below) . This survey will take approximately (time) and be open from (date) to (date)

Sincerely,

Gabrielle M. Arnes,

Graduate Student

University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor

Carrie King, PhD, RD, LD, CDCES

Professor Dietetics and Nutrition

Director Dietetic Internship and Future Graduate Program

Email subject line: Participate in a research study about microplastics to win one of four \$25 Amazon.com gift cards!

Dear Future Graduate students,

One week ago, we emailed you an invitation to participate in this study. Your participation in this study is important and valuable. Your contribution would be greatly appreciated.

What an opportunity to:

Increase your knowledge of microplastics?

Participate in a study that uses on-line learning?

Be entered in a drawing for a chance to win one of four \$25 Amazon.com gift card

If you're a Future Education Model Graduate Programs (FG) currently enrolled in an ACEND program, click the link below (insert link below) . This survey will take approximately (time) and be open from (date) to (date)

Sincerely,

Gabrielle M. Arnes,
Graduate Student

University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor

Carrie King, PhD, RD, LD, CDCES

Professor Dietetics and Nutrition

Director Dietetic Internship and Future Graduate Program

Email subject line: Participate in a research study about microplastics to win one of four \$25 Amazon.com gift cards!

Dear Future Graduate students,

Recently, we emailed you an invitation to participate in this study. Your participation in this study is important and valuable. Your contribution would be greatly appreciated.

What an opportunity to:

Increase your knowledge of microplastics?

Participate in a study that uses on-line learning?

Be entered in a drawing for a chance to win one of four \$25 Amazon.com gift card

If you're a Future Education Model Graduate Programs (FG) currently enrolled in an ACEND program, click the link below (insert link below) . This survey will take approximately (time) and be open from (date) to (date)

Sincerely,

Gabrielle M. Arnes,
Graduate Student

University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor

Carrie King, PhD, RD, LD, CDCES

Professor Dietetics and Nutrition

Director Dietetic Internship and Future Graduate Program

Appendix H - Cover Letter to Potential Participants

Dear Future Graduate Students

My name is Gabrielle Arnes. I am a graduate student in the Dietetics and Nutrition program at the University of Alaska Anchorage (UAA), School of Allied Health. I would like to invite you to participate in a research study focused on microplastics. The purpose of the research study is to assess the knowledge, attitudes, and behaviors of Future graduate students towards microplastics.

All participants who complete the survey will be offered an opportunity to win one of four \$25 Amazon.com gift cards

You may take part in this study if you:

- Are 18 years or older
- Are a Future Graduate student
- Are living in the United States of America
- Have approximately (time) to complete the survey
-

There are no known risks for participating in this study except for the remote possibility that your email address would be inadvertently disclosed. However, the principal investigator has put in place adequate protection for your privacy and data. By participating, you are voluntarily agreeing to consent to this research study and giving your permission to use your responses in aggregate form for research purposes.

Your responses will not be shared with anyone outside of the study. Your responses to the survey are confidential. This project was reviewed by the UAA Institutional Review Board and found to qualify for Exemption 2.ii.

I will send out a follow-up email one week and two weeks following the email to encourage participation in the study. This survey will be open from (date) to (date).

The aggregate results of this study will be e-mailed to participants, upon request, once the study is completed.

If you have any questions regarding this study, feel free to contact me (gblack@alaska.edu and 907-308-0102) or my committee chair, Carrie King PhD, RD, LD, CDCES (cdking@alaska.edu and 907-786-6597). If you have any questions or concerns about your rights as a research participant, please contact the UAA Office of Research Integrity and Compliance at 907-786-1099 or uaa_oric@alaska.edu.

Please complete the following steps if you would like to enroll in this study:

1. To confirm your eligibility and for information on how to participate in this study complete the screening process available in the link at the end of this page.
2. If you meet the study eligibility criteria, decide if you want to participate in the study.
3. If you agree to participate you will be asked to complete a survey that will take approximately [time] to complete. Upon completion of the survey, you will have the opportunity to be entered into four random drawings for a chance to win one \$25 Amazon.com gift card.

Thank you very much for considering this opportunity.

Sincerely,

Gabrielle Arnes
Graduate Student
University of Alaska Anchorage, School of Allied Health, Dietetics and Nutrition

Graduate Advisor:

Carrie King, PhD, RD, LD, CDCES
Professor, Dietetics & Nutrition
Director, UAA Dietetic Internship and Future Graduate Program

Appendix I - Informed Consent

Principal Investigator:

Gabrielle Arnes

Graduate Student, University of Alaska Anchorage, School of Allied Health

(907) 308-0102

E-mail: gblack@alaska.edu

Research Supervisor:

Carrie King, PhD, RD, LD, CDCES

Professor, Dietetics & Nutrition

Director, UAA Dietetic Internship and Future Graduate Program

Phone: (907) 786-6597

E-mail: cdking@alaska.edu

DESCRIPTION:

I am conducting research about the knowledge, attitudes, and behaviors of Future Graduate Students toward microplastics

I will ask you to complete a survey. The survey asks some basic questions about who you are (your age and gender, for example). You will be asked to assess your knowledge, attitudes, and behaviors on microplastics.

VOLUNTARY NATURE OF PARTICIPATION:

Your participation in this study is voluntary and is not a requirement. If you don't wish to participate, or would like to end your participation in this study, there will be no penalty or loss of benefits to you to which you are otherwise entitled. In other words, you are free to make your own choice about being in this study or not, and may quit at any time without penalty.

CONFIDENTIALITY:

No names or identifiers will be published. While we will have your contact information and your survey responses, we will not link these and they will be held in confidence. The results of the survey will be compiled and reported in aggregate form. No individual reporting of surveys will be done.

BENEFITS AND INCENTIVES TO PARTICIPANTS:

There is no direct benefit to you from participating in this study. The results of this study may benefit other people by helping us learn about the role of the RDN in culinary medicine.

Upon completion of the survey, all participants will have the opportunity to be entered into four random drawings for a \$25 Amazon.com gift card.

RISKS:

There are no known risks to you for participating in this study.

CONTACT PEOPLE:

If you have any questions about this research, please contact the Principal Investigator at the phone number listed above. If you have any questions or concerns about your rights as a research participant, please contact the UAA Office of Research Integrity and Compliance at 907-786-1099 or uaa_oric@alaska.edu.

CONSENT:

Please print a copy of this page, take a screenshot with your device, or save a copy of this form in some way for your future reference.

By clicking the continue button below, you are showing that you understand what this study is about. You are also showing that you understand what we are asking you to do for the study, and that you are continuing voluntarily. If you have any questions about this study you can contact the researchers listed above.

Appendix J - Random Drawing for Incentive

If you would like to participate in a random drawing to win one of four \$25 Amazon.com gift cards, please provide the following information:

Name:

Email address:

You will be notified via email if your name was randomly selected. Thank you for your participation!