



Sociocultural influences on dietary behavior and meal timing among Native Hawaiian and Pacific Islander women at risk of endometrial cancer: a qualitative investigation

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Abstract

Purpose Determine sociocultural influences on dietary behavior, body image, weight loss, and perceptions of the cultural appropriateness of a meal-timing intervention design and menu among Native Hawaiian and Pacific Islander (NHPI) women at risk of endometrial cancer.

Methods Six 90-min videoconference focus groups among NHPI women ($n = 35$) recruited by a community champion in Utah. Eligible women were aged ≥ 18 years at risk of endometrial cancer (i.e., $\text{BMI} \geq 25 \text{ kg/m}^2$, history of non-insulin-dependent diabetes or complex atypical endometrial hyperplasia) had a working cell phone capable of downloading a phone app, could use their cell phone during the day, and were not night-shift workers. Twelve semi-structured questions were posed during the focus groups. Using inductive qualitative methods based on Hatch's 9-step approach, de-identified transcript data were analyzed.

Results Overarching themes included economic factors, cultural influences, meal choice and timing, and perceptions of health. Subthemes included affordability, waste avoidance, inundated schedules, and cultural influences. Perceptions of body size and weight loss were influenced by family, community, and social media, whose messages could be conflicting. Important intervention components included satisfying, convenient pre-made meals, while barriers included the need to cook for family members.

Conclusions Dietary interventions targeting metabolic health among NHPI women should consider the multitude of socio-cultural and economic factors that influence food choices and meal timing in this population, including affordability, hectic schedules, and immigrant adjustment. Promoting the link between physical and mental well-being as opposed to weight loss is a key approach to reaching this population.

Keywords Diet · Meal timing · Obesity · Health · Native Hawaiian · Pacific Islander · Endometrial cancer

Introduction

People with Native Hawaiian or Pacific Islander (NHPI) ancestry are the fastest growing racial/ethnic group in the U.S., yet this population—which includes the indigenous peoples of Hawaii, Guam, Sāmoa, and thousands of islands in Polynesia, Micronesia, and Melanesia—is vastly underrepresented in National Institutes of Health (NIH) grant funding (0.18%) and health research [1].

NIH-level funding is needed to strategically support culturally grounded approaches to disease prevention that reflect the population's views, beliefs, customs, and social support structures [2–4]. Further, racial categorization of NHPI individuals in health research is commonly combined with other Asian groups, yet their underlying genetics, lifestyle, and risk of chronic diseases is vastly different [5].

Worldwide, women with NHPI ancestry are at strikingly higher risk of developing cancer of the uterus and other sites, and have worse disease-free survival compared with other racial/ethnic groups [6–8]. Elevated risk may be driven by a higher prevalence of cardio-metabolic cancer risk factors including obesity, metabolic syndrome, and diabetes. Indeed, obesity rates in Pacific Island nations are the highest

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in the world, [9, 10] with evidence for genetic predisposition [11].

Utah has the fifth largest NHPI population among U.S. states [12]. NHPI health statistics are comparable across U.S. states [13–16]. Compared with other racial/ethnic groups, NHPIs have the highest rates of cancer risk factors like obesity (78%) and low vegetable intake [17], second highest rates of diabetes (13.1%), the highest rates of the most prevalent cancers, and the highest mortality rates from cancer, diabetes, stroke, and coronary heart disease [17]. Thus, strategies to mitigate cardio-metabolic disease risk are critically needed in this population.

The cultural context of cancer for NHPIs is essential to consider when designing interventions for cancer prevention. European colonization and resulting oppression instigated poor NHPI health. Hydrogen bomb testing during the Cold War on the Marshall Islands and French Polynesia that was linked to spikes in cancer incidence has perpetuated fears surrounding cancer in the NHPI community [18]. Cancer disparities among NHPI groups are exacerbated by low uptake of cancer screening, and disproportionately high financial toxicity after a cancer diagnosis [18]. Endometrial cancer is the most common gynecologic cancer among NHPI women [19, 20], with rates projected to grow exponentially in the next decade driven in part by the obesity pandemic [21, 22]. Strategies for cancer risk reduction include diet and physical activity interventions for weight management, although such programs have shown variable success in NHPI communities [23].

Meal-timing modification is a novel behavior-change paradigm with potential for improving metabolic health. Irregular timing of daily food intake can influence energy and hormone metabolism, contributing to obesity and metabolic dysfunction [24–27]. Time-restricted eating (TRE)—where all daily calories are consumed within 8 to 10 h, followed by a 14- to 16-h overnight fast—has been shown to improve insulin resistance, glucose tolerance, dyslipidemia, hypertension, and systemic inflammation [24, 28–31]. Weight and fat loss may also occur with meal-timing regulation such as TRE, despite a lack of intentional caloric restriction [29, 32–34]. Early clinical studies demonstrate good adherence to TRE [27, 35, 36], suggesting it may address barriers to dietary behavior change [37–40].

Compared with other research approaches, culturally adapted and grounded intervention design that employs community-based assets (i.e., community-based participatory research) demonstrates more successful, sustainable, and scalable interventions in NHPI communities [2]. To date, however, a cultural adaptation of a TRE intervention has not been tested in NHPI women. We designed this study to qualitatively investigate sociocultural influences on dietary behavior, including meal timing and food choices, perceptions of the cultural appropriateness of a TRE diet

intervention study design and menu, and perceptions of body image and weight loss among NHPI women residing in Utah who are at risk for endometrial cancer.

Data and methods

Study design and eligibility criteria

Participants were recruited to and enrolled in phase 1 (video-conference focus groups) of the Time Restricted Eating in NHPI Women at Risk of Endometrial Cancer (TIMESPAN) study (NCT04763902). We conducted six 90-min focus groups, each comprising up to 7 NHPI women (total $n = 31$ completed). Inclusion criteria mirrored those proposed for a future TRE dietary intervention: Eligible participants were NHPI women aged 18 years or older who were at risk for endometrial cancer (i.e., with a body mass index [BMI] at or above 25 kg/m² or a history of non-insulin dependent diabetes or complex atypical endometrial hyperplasia); had a working cell phone capable of downloading a phone app; could use a cell phone during the day; and not night-shift workers. Exclusion criteria included being on a special diet, having insulin treated diabetes, history of hysterectomy, and inability to provide informed consent.

Recruitment, data collection, and setting

The University of Utah Institutional Review Board approved the study protocol (IRB #00127142) prior to data collection. Women were recruited with assistance from our coauthor (FTP), a Community Champion (ComC; our fourth author [FT]) at the National Tongan American Society who has close links to other key NHPI community groups. Other recruitment sources included referrals from providers who see women with a history of complex atypical endometrial hyperplasia (a potential endometrial cancer precursor), and screening by the study team of patients at a gynecology clinic. The ComC provided women with a study flyer and contact information for study staff. The study coordinator contacted women who expressed interest in participating by phone to address questions and provide focus group details; participants in turn provided their contact information, including an email address. Before the focus group, participants received by email a study-specific, Health Insurance Privacy and Accountability Act-compliant link to a baseline survey that measured demographic characteristics and verified eligibility (i.e., age, ethnicity, height, and weight) and a consent cover letter, which they were asked to view and complete. Participants were informed that their participation in the focus group implied consent for this research and included permission to record their voices. Participants who

completed the demographic questionnaire and attended a focus group received a mailed \$50 gift card as compensation.

Focus groups were held using University of Utah Zoom videoconferencing capability. A 12-question, semi-structured focus-group guide was developed, with questions designed to understand sociocultural influences on dietary behavior (3 questions on food choices and meal timing); perceptions of proposed meal plans and intervention design (5 questions); and perceptions of body image and weight loss (4 questions); Table 1. The focus group guide originally included questions about perceptions of cancer risk; however, we were advised by our ComC to remove those questions that may be confronting. A study facilitator facilitated each session, following the focus-group guide. The ComC also attended each focus group. Sessions were audio-recorded with two devices (i.e., using both the Zoom recording feature and a handheld recording device), transcribed verbatim, and checked for accuracy.

Data analysis

Data analysis took place from March to July 2021. De-identified focus group transcript data were analyzed using an inductive qualitative approach based on Hatch's 9-step approach, with some variation as previously employed by our team [41, 42]. Two study coauthors (EMP and EB) analyzed the data transcripts using multiple-cycle coding and constant comparative data analysis methods [43, 44]. They

and the second author (TNR) met every other week during the coding period to resolve conflicts, discuss emerging content, and make necessary changes in coding logistics. If there were discrepancies in the coding period, conflicts were resolved by the second author (TNR). Google sheets were used to store the code book and organize de-identified transcript "text chunks" and their associated codes, along with any newly identified themes. Demographic information was summarized as mean and standard deviation for continuous variables and number and proportion of participants per group for categorical variables, using SAS version 9.4 (SAS, Cary, NC).

Results

Sample characteristics

The baseline questionnaire was completed by 35 predominantly Polynesian women whose mean age was 33 ± 9 years; 32 were NHPI and 3 mixed race (NHPI and other); none were Hispanic or Latino. Most women had some college education (52%) or completed high school (34%), and were married (54%). The majority of participants worked either full time (54%) or part time (20%). Total combined household income was lower than \$50,000 among 37% of participants, although 29% elected not to report their income. Most lived with other people, with household sizes ranging from

Table 1 Focus group questions

Meal timing and food choices

What influences your food choices generally? What are some of the cultural influences on your food choices related to having Native Hawaiian or Pacific Islander heritage?

How does your culture or community influence your meal timing or *when* you eat your meals or snacks in the day? How does weekday meal timing differ to weekend meal timing?

How would you feel about changing the timing of your daily meals to improve your health (such as eating all your meals and snacks within an 8 or 10-h period)? What are potential barriers to consuming all daily food and drinks that have calories in a specific window of time, like eating only between 8am and 6 pm? What would make it easier for you to consume all your meals and snacks within an 8 to 10-h period? What is the shortest eating window you think that you could tolerate?

Study design

Please view the example menu on your screen proposed for a meal timing study among Native Hawaiian Pacific Islander women. Here you can see 7-days of meals that would be repeated over a total of 8-weeks (there would be a 4-week break in the middle where study participants could go back to their usual diet). Lunch and dinner would be provided as frozen meals and then a menu of suggested breakfast and snacks will be provided (show). The menu is designed to be nutritionally balanced for the study participant to maintain their current body weight (or keep their body weight the same throughout the study)

Please provide your opinions on the appeal of this type of menu

What are some barriers to making this meal plan work in your lifestyle?

How would receiving 8-weeks of frozen lunch and dinner meals for yourself, as a study participant, impact your meal planning and preparation at home?

How could this menu be improved?

Perceptions of body image and weight loss

What does a healthy body mean to you? What is your vision for the ideal healthy body shape and body size?

What influences your views on the ideal healthy body shape and body size?

How do you feel about intentional weight loss to get to a smaller body size?

How would you feel about changing your diet to improve your inner health without any weight loss?

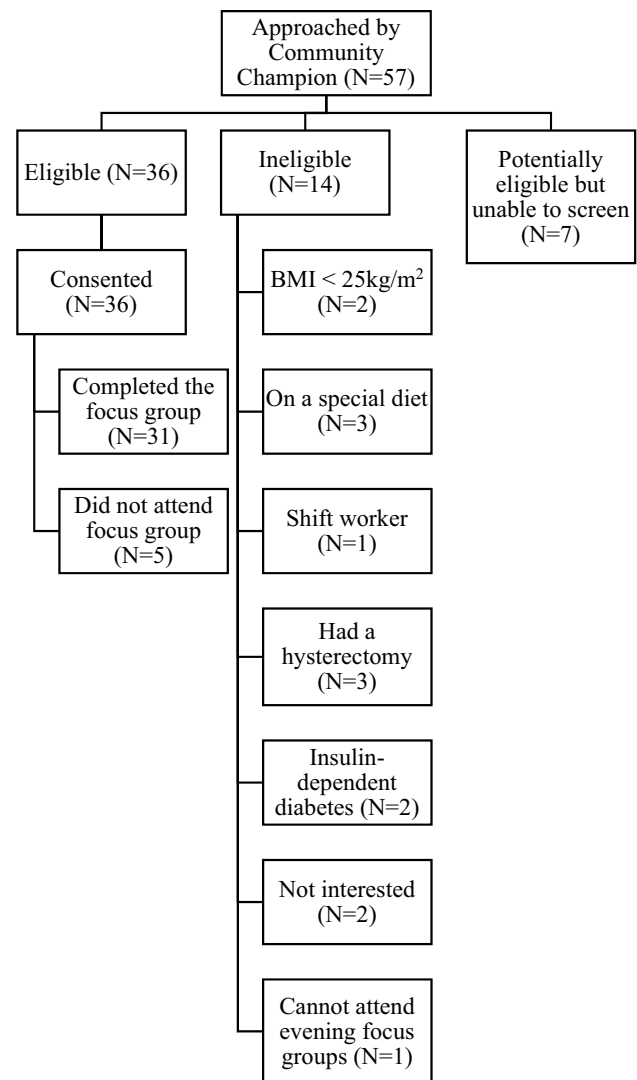
Table 2 Characteristics of focus group participants in the TIMES-PAN study

Characteristic	n (%) or mean \pm standard deviation (range)
Age	33 \pm 9 (range 19–60)
Race	
Native Hawaiian/Pacific Islander (NHPI)	32 (91)
Mixed race (NHPI and other)	3 (9)
Ethnicity	
Hispanic or Latino	35 (100)
Not Hispanic or Latino	0 (0)
Education	
< high school	1 (3)
High school	12 (34)
Some college	18 (52)
College	4 (12)
Graduate school	
Marital status	
Married	19 (54)
Not married	16 (46)
Household size	5 \pm 3 (range 2–18)
Employment	
Full time	19 (54)
Part time	7 (20)
Full-time homemaker	3 (9)
Student	1 (3)
Unemployed	5 (14)
Total combined household income	
< \$20 K	2 (6)
\$20–49 K	11 (31)
\$50–89 K	8 (23)
\$90– < 120 K	3 (9)
\$120 K +	1 (3)
Prefer not to answer or unsure	10 (29)
Body Mass Index (BMI, Kg/m ²)	38.4 \pm 8.9 (range 27.4–66.2)
2-year body weight change (lbs)	13 \pm 29 (range – 57 to + 90)

2 to 18. Mean BMI was 38.4 kg/m², in the obesity class II range. Additional demographic characteristics are presented in Table 2. The number of women screened, consented, and that completed the study, and reasons for ineligibility are presented in a study schematic in Fig. 1.

Themes

Four overarching themes emerged in the analysis: economic factors, cultural influences, meal timing and food choices, and perceptions of health. Subthemes within each overarching theme are described below. Table 3 presents selected descriptive quotes that emphasize and support key points.

**Fig. 1** Study schematic

Economic factors, the most prominent overarching theme, were essential to when and how participants prepared meals and made food choices for themselves and their families. *Affordability* and the consequences of working long hours and *undated schedules* influenced food choices. For example, being raised in a single-parent/income home limited dietary choices in the family. Fresh fruits and vegetables were perceived as expensive with quick spoilage that prevent healthy food choices, although several women stated that they would eat more healthily if they could afford it. Many women spoke of not wanting to *waste food* related to their upbringing, which instilled a mindset of overeating. Lacking energy to prepare meals after working long hours was also a common theme.

Participants extensively discussed **NHPI cultural influences** on diet, food choices, and eating habits. Cultural influences included family and friends, specific ingredient

Table 3 Participant quotes from focus groups in the TIMESPAN study

Subthemes	Participant Quotes
Overarching Theme: Economic Factors	
Affordability	<p>I'm very frugal when it comes to food...budget plays a lot in how I get food for the home.</p> <p>We wanted to do a more plant-based diet, but it's very expensive...we have a big family, so we just went back to what we were eating before. That's what we could afford.</p>
Avoiding Waste	<p>We were taught not to be wasteful," and, "when I grew up, my dad was always saying, "There's starving kids...who don't get to eat this food. So...finish whatever's on your plate."</p> <p>Coming probably from lower socioeconomic status...we have this guilt if we don't finish our food.</p>
Inundated Schedule	<p>By the time I get off of work, I'm so tired and I will make the simplest thing possible.</p> <p>Work in general for Polynesian people...I think we all brought up how work is so busy and that's a huge barrier to how we eat and what we're eating.</p>
Overarching Theme: Cultural Influences	
Assembly	<p>When people would come over for big events...weddings, funerals, birthdays, and stuff. There's always going to be a huge amount of food there, but also when family comes into town, um, you're also eating on top of that. You always have to feed your family out of town. You're always feeding somebody before you go to the actual eating.</p> <p>If you have something in front of you, you're going to eat it all... you're going to finish your meal...even in large gatherings for Pacific Islanders and Tongans...a lot of our comradery and relationships are built around food...if we have an eating, you know, for a celebratory reason, or, you know, even in mourning for someone's passing...a lot of that is spent with eating food.</p>
Traditional cuisine constituents	<p>Mayonnaise. We eat Best Foods mayonnaise with everything...no offense to Utah, but the food here sucks. There's no taste I feel like to a lot of the food and we love that.</p> <p>A lot of starches...Lot of meat...A lot of unhealthy things," and, "we eat a lot of starches...from taro to rice to potatoes and bread.</p> <p>Watching people make odai and just pour a whole bag of sugar in a cooler. I look at it and I'm like, dang, this is why we all have diabetes. And then you just take like ten cups and I'm like, 'oh, well that's all right'. You can fix it later and drink water...you try to justify that it's okay, 'cause it's good and stuff.</p> <p>Eating a whole can of corn beef to myself is like the best thing that makes my heart happy. It's like, with some Tabasco sauce and some other things on it. Like it's so good just out of the can, not even cooked, not nothing.</p> <p>There has to be like three different options of carbs. And then there has to be, nobody talks about a salad, like maybe a crab salad, maybe a potato salad. But other than that, it's not like healthy green salads are ever brought up.</p> <p>Growing up in Samoa...a lot of everything we made was fried. Probably the healthiest thing to eat was fish, but coconut milk is always added which makes it not as healthy...I don't remember ever eating a bunch of veggies growing up [other participants laughing and nodding].</p>
Expression of sentiment	<p>For most Pacific Islanders, I think the reason we eat too is different... the social, um, aspect of it, the, um, we just went a lot of happiness with the food that we consume, you know, and it's always around family gatherings or, uh, you know, with your friends, like that's how we gather and, and that's what we do when we gather.</p> <p>Growing up...when we feed someone, that's how we show our love.</p>

Table 3 (continued)

Subthemes	Participant Quotes
Adversities of immigrant-adjustment	<p>It's hard to try and adapt and fit into the lifestyle here [U.S.] where people are eating regular, portioned and timely meals when we've been so used to eating freely whenever/wherever.</p> <p>Being a first generation here in America, we grew up eating whatever mom or grandma made, we never really had a choice in what we ate." <i>Several women also expressed how limited income impacted their food choices</i>, "it's just different from our parents coming here to America and all they knew was just work, work, work, and they needed to provide for us and...have a roof over our head.</p> <p>In reality, a lot of the [cultural] dishes have been modified when we talk about like lupulu, which is, corn beef with leaves. And I don't know what kind of leaves exactly, but you know, green leaves and so a lot of people use other substitutes now and tend to be more fattening and higher in caloric value.</p> <p>Like gece, you know, they were made differently back then. And so, a lot of other things now have been incorporated in a ways that are very unhealthy.</p>
Overarching Theme: Meal Timing & Food Choices Skipping Breakfast	<p>...Our people [Polynesians], I think in general, we're not breakfast people...</p> <p>I just drink coffee and I won't eat until 12:00 or even 2:00, like later in the afternoon...I'll be fine and not be hungry. But then that also leads me to eating larger portions later in the day.</p>
Schedules dictating eating patterns	<p>It's not good to not eat all day and then eat a lot....at the end of the day or sometimes like [I] don't even eat because it's, I'm so busy, and by the end of the day, I'm so tired. I just go to sleep...even if I cook dinner, I don't eat dinner, I just go to sleep.</p> <p>I think us Polys [Polynesians], we just go, go, go and we eat on the go...if I were to compare myself to like maybe an American family, you know, there's a mom that comes home and makes dinner at a certain time. I feel like me and my household, I'm always on the go with my children. I'm always on the go with my family, so we eat dinner wherever it is. Um, you know, and I think, I think a lot of people can relate culturally like that...</p>
Meal characteristics: taste, flavoring, and variety	<p>For me, I'm a spice person. I like spicy stuff...if I was to cook, I would always make sure it has a lot of spice and flavor.</p> <p>When I talk to my mom...her being...born and raised in Tonga, as well as my father, they talked about the difference of how they would use to cultivate the land and actually incorporate a lot of greenery into their foods...there's this shift in Western colonization where we have seen a lot of our cultural dishes, um, adapt to...just growing needs of, um, things just tasting different and tasting better."</p>
Colonization, neighborhood grocery availability	<p>I've noticed that in poorer areas, they have, like, chips and, like—yeah, things, things like that aren't as healthy. And then in the richer areas they have healthier foods.</p> <p>In reality, a lot of the dishes have been modified...when we talk about like 'lupulu', which is, um, corn beef with...green leaves...there's a shift with that.</p>
Interpersonal Influences	<p>I think...family tradition, because a lot of things I eat is from things that I ate since I was a little kid and I'm just used to eating that same kinds of food."</p> <p>Social media or friends who are like, "Oh, have you ever tried this place?" And it's like, oh, I wanna try that out. That looks good,</p>

Table 3 (continued)

Subthemes	Participant Quotes
Overarching Theme: Perceptions of Health Weight Loss	<p>If you don't have the right mindset, it doesn't matter what kind of weight loss you have...mental health plays a huge part I think of our inner health.</p> <p>"My mom talks about what size she was at my age and compares...I would see what's ideal to like how my mom and my aunts looked at my age.</p>
Mind-body connection; wellness over weight loss	<p>The purpose is not for me to lose the weight or to get back to a certain size. It's more to get back to that state where I can move around and do what I need to do.</p> <p>For Polynesians too, inner health means more than what you eat. It's like your spirituality...everything, physical, emotional.</p> <p>...I don't think a lot of Pacific Islanders realize that what we put in our mouths has a lot to do with all of that health. And, because we don't talk about mental health, we just don't know, you know? And, it's easier to talk about like, stop smoking or stop drinking, 'cause you're gonna get sick or you're going die early or whatever.</p> <p>I feel like our parents' generation don't get that or, you know, when they talk about work, they're like, "Oh, I work, work, work, work." You know, there's no room for self-care. They're like, "What is that? You know, I just worked and I, you know, come home." So, I think that just has a big thing to do with it because more and more we're talking about, mental health and self-care in the workplace, but I just, I don't think that's reaching Polynesians my parents' age, that generation.</p> <p>Cause in Polynesian culture that's almost taboo to speak on, you have to act like you're fine and you don't have issues...these things [healthy meals] will make you healthier and therefore happier and less stressed and thereby improve your mental health.</p> <p>Even just the education of that [mental health]... a lot of pacific islanders don't realize a lot of what we put in our mouth has to do with our mental health and a lot of people don't talk about that. When you talk about stress, we don't talk about that [mind-body connection]...</p>
Discipline to make changes and previous attempts at dieting	<p>...For a little while it [dieting] works, and then...I get so busy that it doesn't work long-term for me,</p>
Western standards of beauty and social media influence	<p>I just don't think I can do [it]...I don't like feeling restricted [in eating].</p> <p>It's all that [social media] input...it's a lot of negativity that affects and influences the way you look at yourself, but also the way you look at others.</p> <p>For me as a Pacific Islander, I'm like...I look pretty great. I guess if you want to compare stature to other Pacific Islander women, I felt really in shape. But then I compare myself to my White counterparts and I'm like...I'm so fat.</p> <p>We're always considered obese on a BMI scale and we know that that's not reflective of who we are...it's not made for our body types, and this Westernized culture doesn't always match up with ourselves and our body types.</p>
Resource availability and self-education	<p>I feel like a lot of information is available. You just got to know where to look and find it and be in a supportive system,</p> <p>I don't think a lot of Pacific Islanders realize that what we put in our mouths has a lot to do with...health.</p>
Obligations to family; health in order to fulfill responsibility	<p>I just want to be healthy...so I can live longer so I can enjoy my grandchildren,</p> <p>We don't have kids yet...I worry that I won't be able...to live life with them and have experiences...that require me to be active and healthy.</p>

Table 3 (continued)

Subthemes	Participant Quotes
<p>Overarching Theme: Study Design</p> <p>Cooking for family and community as a barrier to adopting a meal plan</p>	<p>I would definitely do it. My question is this just for us or is this for us and our family? Do we have to then prep meals for our family?... It might not work because we're the ones that have to make the meal for our families, so whatever it is we're having is what our family is having. I would love to participate and have these meals but then I have to think about what to make for my family and it all goes back to the whole time constraint of things.</p> <p>Teach it [meal planning] in a way that it's not restriction...it's habitual. It's about creating good habits for me and my family so that when we look at food...we're not feeling a deficit.</p>
Reaching satisfaction with study-provided meals	<p>Maybe the only barrier would be if you weren't full, honestly, if you didn't get full off of that, you'd go get something else to eat,</p> <p>"It looks like a great menu. It looks like great food that's really well prepped. I don't see any other barriers for why we wouldn't be doing this, unless it's not fulfilling, or the taste isn't good."</p>
Convenience of pre-made meals	<p>I'm all for it as long as I don't have to take the time to go and do everything else throughout my day. I don't have to like, go get it all, come home and make it all, put it all away, worry about when it's going to go back. As long as I don't have to do any of that I'm all for it.</p> <p>"It would be easier too- if they are already premade. Make it so much easier for me because that's when I start to eat junk- when the food isn't ready at a certain time.</p> <p>The reason we are not creating these kinds of meals is because of the time of the day for us. Always so busy, and budget too. These meals look like great hearty meals that have already been prepped.</p>

choices, the expression of love and care through food, and the impacts of being first- or second-generation immigrants to the continental U.S. Participants listed the social component of eating as a significant cultural influence on their dietary habits; the impact of family and friends was inseparable from culture and community *assembly* or gatherings. Family gatherings are an opportunity for those with busy schedules to have home-cooked meals and connect with community. Many participants mentioned that their families more frequently ate out on weekends, which was perceived as a barrier to healthier eating.

It emerged that the NHPI community *expresses sentiment* (love and care) through food. A study participant offered the example of accepting and consuming a meal when offered, despite having already eaten, to show respect and express care or sentiment. Participants agreed that refusing food could be interpreted as disrespectful, and it is common for women to cook and provide for others before themselves. First- and second-generation immigrants described how older family member traditions established the family's eating patterns. Long working hours intersected with the adversities of immigrant adjustment, where working long hours and associated fatigue created barriers to preparing meals, maintaining regular mealtimes, and providing consistent, nutritious homemade meals.

Though participants listed a variety of *traditional cuisine constituent staples* in NHPI communities in Utah, mayonnaise, meats, and starches were repeatedly noted as important dietary components. Participants also noted that a lack of fresh fruit and vegetables contributed to less-healthy diets. Many participants noted the abundance of starch in their diet. Some popular dishes for NHPI families did contain vegetables; these were favored options on the menus presented as part of the study design.

Meal timing and food choices was the third most common emergent theme. Participants reported that work *schedules* and time and economic constraints promote consumption of ready-made and convenience foods, and regularly *skipping breakfast* is common. One woman stated that she believed she skipped breakfast as an adult because as a child she had become accustomed to receiving breakfast at school. This subtheme intersected with long working hours and busy schedules. Balancing work and children's school and sports commitments was a barrier to grocery shopping, meal preparation, and maintaining a regular meal schedule. Lack of time and energy due to intensive work and home schedules were repeatedly linked to less-regular mealtimes.

Meal characteristics that were described as central to NHPI food choices include taste, flavor, and food variety. Participants expressed concern about access to healthy foods that tasted good and had vibrant flavors. They noted both

current and past attempts at healthy eating, but that improving their family's eating habits had been unsuccessful. Food taste was cited as a central component of successful dietary change. Participants noted a lack of fresh fruit and vegetables in their current diet but indicated a desire to include them in popular dishes such as curry.

Lack of *grocery availability* and the impacts of *colonization* and immigration also affected study participants' food choices, with less-healthy store-bought foods replacing traditional ingredients that families would have cultivated on their own land prior to immigration to the U.S. Traditional family recipes prepared by grandparents or family members while growing up influenced current personal food choices and choices made for/by the family. Participants noted a strong collectivist culture, whereby *interpersonal influences* such as the likes and dislikes of one person in a household influence the food served to the whole household.

Family, spiritual beliefs, and social media all influenced participants' **perceptions of health**. Remarks from family members concerning the need for participants to lose weight were commonplace and affected participant self-perception. Social media was also described as pressuring participants to focus on outer appearance, but participants emphasized that they place importance of "inner health" that is tied to spiritual beliefs. Several participants discussed shifting focus from a decrease in pounds on the scale to a decrease in waistline inches as a better measure of health. While intentional weight loss was viewed positively, the intention behind it was perceived as being vital, where weight loss for changing physical appearance was viewed negatively. They described viewing *wellness* as holistic, feeling healthy regardless of body shape/size, and having energy to complete daily tasks and keep up with family and children, rather than incorporating weight loss. Participants described *mind-body connection* where physical and mental health, especially stress, are connected to eating habits. They noted how their parents' generation do not understand or acknowledge links between physical health and self-care (including healthy eating) and mental health, and that speaking about mental health was taboo in NHPI culture.

Intermittent fasting was the most prevalent dieting pattern previously attempted by participants, with varying levels of success and enjoyment. Several participants noted challenges in sticking to their eating and fasting timeframes due to busy schedules or family events involving social eating, and that *discipline* and willpower as necessary to achieve health goals.

Participants described receiving conflicting messages while growing up in the U.S. about body image both within their families and in *social media*. Women perceive that mainstream American culture portrays how thin and fit they should be while traditional NHPI culture told them they should be grateful they have food to eat and should not

complain. For several women, trying to emulate *Western ideals of beauty* strongly influenced their mindset relating to health. In contrast, some viewed social media influences as being positive, allowing for more representation of all body types. One participant described feeling empowered by the visual representation of other women celebrating their bodies in social media, regardless of their shape or size. Many participants noted that in NHPI cultures "bigger is beautiful", but these cultural messages can conflict with Western standards of ideal body type. Participants also stated that they did not feel clinical body size metrics such as BMI accurately represent who they are.

In response to questions about the proposed **study design**, the need to *cook for family and community* was perceived as a barrier to adopting a study meal plan. For example, participants discussed the obligation to cook for many people and were concerned about availability of study meals for family members if only study participants were provided with ready-made frozen meals. Several participants expressed a desire to learn more about meal planning and healthy eating, but having a supportive social environment (family/community) was considered essential for achieving their health goals. Notably, one participant felt conflicted because, although she felt she needed her family's support to achieve her health goals, she did not want to impose dietary restrictions on other family members. Support groups were perceived as a positive way to be surrounded by like-minded people and as fostering an environment in which open sharing of thoughts and feedback was welcomed as part of helping one another to become healthier.

Another concern was whether pre-made study meals would provide *enough food to satisfy* those who participated. Several participants stated if the meals were not filling, they would seek additional food elsewhere. If the study-provided meals were not appetizing, this would present another barrier to participation.

Nearly all focus group participants considered the study's *pre-made meals to be a major convenience* that would make meal-plan adoption more realistic. Some participants asserted that pre-made meals would help to facilitate changing dietary habits and time was a barrier to creating meals like those in the study meal plan.

Discussion

We qualitatively investigated sociocultural influences on dietary behavior, body image, weight loss, and perceptions of the cultural appropriateness of a proposed meal-timing dietary intervention among NHPI women in Utah. We found that economic factors like affordability strongly influenced food choices in this population, resulting in the consumption of less healthy, cheap, ready-made meals. Inundated

schedules and working long hours was common, leading to low energy for meal preparation, frequent eating out, and irregular meal timing. Family tradition and cultural factors like community gatherings and offering/receiving food as sentiment and avoiding food waste heavily influence food preferences and the quantity of food consumed. The constituents of traditional cuisine such as mayonnaise, meats, and starches (e.g., potatoes, rice) with strong flavor profiles emerged as important components to incorporate in future dietary interventions targeted to NHPI women. The perception of smaller or larger body size as positive differed at the individual, community, and social media levels, creating internal conflict. Vitality and holistic health/wellness was emphasized as being more important than body size/shape or weight loss. A successful meal-timing dietary intervention would need to provide satisfying, flavorful, convenient pre-made meals adaptable to a large household and would need to account for food-centered community-based activities.

Unemployment is higher and median household income lower in the NHPI community than in non-Hispanic White households in the U.S. [45]. The 2019 Asian American and Pacific Islander (AAPI) California Workers Survey found that, compared with other subpopulations of Asian ancestry, Pacific Islanders comprised the highest proportion of the working population that still struggled with poverty, a problem most acute among U.S.-born than foreign-born individuals [46]. A 2020 analysis of data from the National Health Interview Survey (an annual cross-sectional survey intended to be representative of the nonmilitary, noninstitutionalized U.S. population) found that 20.5% of NHPI adults in the U.S. experience low or very low food security, compared with 7.7% of White adults [16]. This has major implications for chronic diseases that are cancer risk factors, such as obesity and diabetes. Data from the Behavioral Risk Factor Surveillance System show that food-insecure NHPIs in Hawaii had almost twice the odds of diabetes as NHPI individuals in food-secure households [47]. The economic impact of the COVID-19 pandemic has hit NHPI communities especially hard [48], exacerbating existing disparities [49]. Economic disparities translate to specific groups within the NHPI community such as cancer survivors, of whom 59% report medical financial hardship, compared with 32% of non-Hispanic White cancer survivors [50].

The notion of eating to express sentiment also extended to meal timing, which is reflected in women preparing meals and feeding children and other family members before themselves. Other studies have similarly identified family (extended versus nuclear) and community collectivistic culture as core factors driving dietary choices in the NHPI population [51, 52]. Sāmoans, for example, may engage in a weekly feast, or *to'onai*, during which an average of 6,000 kcal per person may be consumed [53]. Typical dishes include meat-based soups, palusami (e.g., onion

and coconut milk wrapped in taro leaves with or without meat), breadfruit-based recipes, and fa'I (green banana/coconut) recipes. Food choices and meal timing were also influenced by whether a woman was a first-, second-, or a later generation immigrant to the U.S. and by the hectic schedules common in this population of women.

Assessment of dietary patterns among NHPIs in the U.S. has been difficult because the national nutrition surveillance system, the National Health and Nutrition Examination Survey (NHANES), includes NHPIs among "other races" (i.e., other than non-Hispanic White, non-Hispanic Black, and Hispanic) [46]. Among the few nutrition assessments conducted in NHPI adults, a low rate of fruit and vegetable intake has been observed that is similar to that seen in the NH White population. Higher intake of foods high in dietary fat and sugar is also evident [54]. In a multiethnic cohort study, a dose-response was observed for educational attainment and diet quality [55], emphasizing the interplay of socioeconomic factors with dietary choices. Self-reported cooking practices in NHPIs include those contributing to dietary fat and salt intake, such as deep frying and the use of salty marinades [52]. Nonetheless, the Multiethnic Cohort Study found improvements over time in diet quality indices among Native Hawaiians over a 10-year period, in line with those observed in other racial/ethnic groups, although diet quality scores remained low on average [56]. In the same cohort, the top contributors to Native Hawaiians' fruit and vegetable intake were lettuce, carrots, broccoli, tomatoes, leafy green vegetables, stir-fried vegetables, and poi (taro root) [57].

Nutrition transition has been identified as a major contributor to disparities in diet quality among NHPIs. For example, since the early 1900s the availability of traditional foods has waned and socioeconomic factors have contributed to the replacement of these foods by energy-dense, high-sodium, and canned foods [58]. The adversities of immigrant adjustment emerged as a subtheme in our analysis, underscoring that food choices for first-generation immigrants were often dictated by native elders, but were also influenced by affordability. As a result of immigrants' economic struggles, tied to working long hours and irregular mealtimes, "grab and go" meals became common. Study participants suggested colonization has also influenced food sources, with Pacific Island-born elders having grown their own food prior to immigrating to the U.S. that tastes better than store bought options in the U.S. This was noted as one possible reason for high use of condiments like mayonnaise in the acculturated diet.

Inconsistent meal timing is emerging as a key driver of metabolic dysfunction that underlies chronic diseases like cancer [25]. Furthermore, breakfast skipping, which has also been associated with obesity, cardiometabolic diseases, and mortality, was common and was noted to be a cultural

phenomenon also influenced by busy schedules [59–62]. Consequently, tackling inconsistent meal timing and skipped meals may be important dietary behaviors to target in the NHPI community.

Healthy-eating education in the context of holistic health and increasing inner (including mental) health and wellness rather than deprivation was deemed important among NHPI women. Despite high prevalence of mental health disorders, and self-reported need for mental health services, Pacific Islanders in the U.S. report low levels of help-seeking [63], possibly influenced by the stigma of mental illness in the community [64].

Importantly, participants deemed the concept of BMI an inaccurate representation of body health among the NHPI community and a Westernized standard that is inappropriately applied to NHPI health and well-being. In a multicultural study of ethnocultural ideal body size, Native Hawaiians were more likely than members of other racial/ethnic groups to consider larger body sizes to be culturally ideal but had negative attitudes toward this cultural perspective, whereas they selected smaller body sizes as being a Western ideal [65]. It has been postulated that a larger-body-size cultural ideal may be driven by perceptions of genetic predisposition to a large body size and by the historic view among Pacific Islanders that larger body size signifies wealth or royalty, upward mobility, and protection against wasting diseases [66]. Lifestyle programs with a sole focus on behavioral determinants of obesity may be viewed as racist or discriminatory and as discounting strong environmental influences on obesity, such as acculturation with reduced access to healthy food or economic disadvantage [67]. The conflicting views of cultural (large) versus Western (small) ideal body size articulated in our focus groups mirror those reported previously, in which participants noted the negative connotations in being told large body size was a problem and emphasized a belief that the concept of health relates more to the absence of disease rather than to body size [68].

We presented a potential TRE lifestyle intervention aimed at improving metabolic health to gauge its acceptability to NHPI women. TRE emphasizes consistent meal timing and minimizes duration of daily eating, coupled with longer overnight fasting. We found that intermittent fasting (of which TRE is one method) was the dietary strategy that had been attempted most often by study participants, with varying levels of success and enjoyment. The major drawbacks of this approach appeared to be a concern about feeling restricted and/or hungry. Women in our focus groups reported traditionally eating according to hunger rather than at a particular time; thus, TRE would be a major departure from their customary eating habits.

Previous studies have translated lifestyle programs into community-based interventions to address health disparities among NHPI individuals. Family and social support are

vital, as we observed in our focus groups. For example, the Diabetes Prevention Program Lifestyle Intervention (DPP-LI) was translated into a 3-month community program for NHPI adults consisting of weight loss followed by weight maintenance [69]. Socioeconomic and sociocultural factors that were adapted for the target population included economical healthy eating and communication with health-care providers. *‘Ohana*, or group decision making, drove the choice to implement the intervention in a group setting, which was coupled with having participants select a support person, family member, or friend to participate with them. The program proved successful, with modest but significant changes in body weight, blood pressure, physical activity, and dietary fat intake. Education level appeared to be associated with weight-loss success, which could be related to unstable employment, English proficiency, or other stressors affecting engagement. Importantly, different ethnic groups showed varying levels of success, highlighting the need to consider specific within-group needs when designing a lifestyle intervention [69].

It has been demonstrated that interventions are less effective when they do not align with the target population’s cultural values and preferred way of life [2]. As such, the use of a socio-ecological model of health promotion is recommended when designing health interventions targeted to NHPI communities. Strategies that support cultural adaptation include incorporating family and community social support and community peer educators, addressing economic barriers to healthy eating [70], holding research meetings in easily accessible community locations, the ability to deliver intervention in native languages, taking time to develop community relationships prior to study implementation, and honoring other cultural practices such as faith beliefs and oral traditions of participant engagement [3].

A focus on promoting and building wellness that encompasses both physical and mental wellbeing rather than weight loss or body size changes may benefit interventions designed to improve metabolic health. Alternatives to asking about BMI during recruitment is also a consideration. Physical activity is an integral component of energy balance, and warrants consideration in lifestyle intervention among NHPIs. For example, Polynesian dancing contributes to moderate to vigorous aerobic and anaerobic activity energy expenditure [71], and a cultural dance program compared with control led to greater reduction in blood pressure and 10-year cardiovascular disease risk factors among Native Hawaiians [72].

Sociocultural influences on dietary behaviors reported in our study such as family, community and social media, are not unique to the NHPI community, as similar observations have been made among other minority groups. For instance, a lower level of acculturation has been associated with a healthier eating pattern among Latinx immigrants [73].

Moreover, socio-economic status, education, and income are universal determinants of food choices, including caloric density, across cultural groups in the U.S. and elsewhere [74]. Food waste has also been documented as being considered “bad” amongst other immigrant groups [75]. Why the NHPI community experiences health disparities related to cancer and its risk factors to a greater extent than other minority groups in Utah remains unclear. Yet, it is of critical importance to address these disparities with culturally tailored approaches that include community partner participation, which result in greater engagement and more positive study outcomes [76].

Our study has many strengths yet is not without limitations. First, our study faced the common challenges associated with focus groups such as moderator bias [77]. To account for this limitation, we used validated methods for extracting themes in an unbiased manner. Next, the use of purposive sampling may limit the ability to generalize the findings beyond this study’s sample. Additionally, inclusion criteria included having access to working technology since our proposed dietary intervention will include meal timing monitoring using a smartphone app; however, this could have created selection bias. The targeted sample, however, differentiates our study from existing population-based studies in which NHPIs are often aggregated with Asian Americans, attenuating prevalent health disparities [78]. In Utah, where the NHPI community constitutes 1.5% of the population, our study provides invaluable insights into dietary patterns and sociocultural influences on food intake among NHPIs that ultimately contribute to their prevalent chronic diseases, which are heavily influenced by diet [53]. Moreover, since NHPI women experience unique social and cultural barriers, we focused participant recruitment—with the facilitation of our NHPI ComC—on community groups that provide services exclusively to NHPIs.

Our findings are timely given NHPI population growth in the U.S., where acculturation and other factors have led to disturbing rates of metabolic dysfunction and associated cancers [6–8]. Our findings suggest that dietary interventions among NHPI women in Utah may benefit from addressing economic factors and cultural influences on food choices and meal timing such as affordability, busy schedules, social support, and immigrant adjustment factors, including the flavor profile and core ingredients of meal plans. This could include the use of native recipes and the provision of pre-prepared and culturally-tailored meals. These findings will be used to develop a culturally appropriate meal-timing dietary intervention among NHPI women in Utah with the goal of improving metabolic health for cancer prevention.

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Declarations

Conflict of interest Unrelated to this study, Dr. Charles R. Rogers offers scientific input to research studies through an investigator services agreement with Exact Sciences. All other authors have no relevant financial or nonfinancial interests to disclose.

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