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A COMPARATIVE ANALYSIS OF WOMEN'S NUTRITION DECISION-MAKING AUTONOMY DURING PREGNANCY IN BURKINA FASO AND MADAGASCAR

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Abstract

Objective: The study aimed to conceptualize maternal nutrition decisions in Yako and Ziniare, Burkina Faso and Itasy and Vatovavy Fitovinany, Madagascar using the Food Choice Process Model by 1) describing typical maternal diets during pregnancy, 2) understanding multi-level factors that influence women's nutrition decision making, and 3) exploring the extent to which women have nutrition decision-making autonomy during pregnancy.

Method: This multi-phased, formative study was conducted between Oct. 2020 - Feb. 2021 in Burkina Faso and Madagascar. Semi-structured interviews, focus group interviews, and free lists were conducted among pregnant and lactating women. Textual data from focus groups and semi-structured interviews were digitally recorded and translated verbatim from local languages into French. The Food Choice Process Model guided textual content analysis using Dedoose software. Free list data were analyzed using cultural domain analysis in Anthropac.

Findings: women during pregnancy receive nutrients through diets consisting primarily of staple foods, including rice and *tô* (millet or maize-based dough) in Madagascar and Burkina Faso, respectively. While locally available vegetables and fruits are sometimes consumed when available, animal-source foods are rarely eaten among these samples. Differentially between contexts, maternal nutrition is influenced by a synergy of upstream factors that influence individual food choices, including available resources, social influences, and personal characteristics and ideals. While shared decision-making within key domains of autonomy (e.g., household finances) is the norm between men and women in Madagascar, men were the primary decision-makers across all areas of inquiry among the sample of participants from Burkina Faso.

Conclusion: Sub-optimal maternal diets are determined by inter-related, multi-level factors in Burkina Faso and Madagascar. Further exploration on decision-making autonomy and its role in women's ability to consume optimal diets during pregnancy in these settings should be considered.

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List of Abbreviations

Abbreviation	Definition
DHS	Demographic Health Surveys
LBW	Low Birth Weight
MMR	Maternal Mortality Rate
WHO	World Health Organization

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Chapter 1: Literature Review

Global and regional burdens of maternal mortality and nutrition

In 2017, the World Health Organization (WHO) reported that the global maternal mortality rate (MMR) was 295,000 women, with sub-Saharan Africa accounting for 66% of the global estimate.pali[1] MMR remains high in Madagascar and Burkina Faso, impacting 335 and 320 per 100,000 births, respectively.[1] These rates are below the average, when compared to sub-Saharan Africa (542 per 100,000 births), but above the global average (211 per 100,000 births).[1] The high rates of maternal mortality are often attributed to lack of adequate health, including lack of permission to seek medical care, inadequate nutrition intake, financial access, transportation, and distance to the health center.[2,3] Inadequate nutrition in low- and middle-income countries has been attributed to 450 million women being affected by short stature, 240 million women suffering from undernutrition, and 468 million women impacted by anemia.[4] Across Africa, the prevalence of anemia is 40.1% among pregnant women and 32.5% among non-pregnant women. Approximately, 9.4% of women in Africa were found to be underweight, defined as less than 18.5 kg/m^2, indicating that both anemia and underweight are a concern in Africa.[5] Undernutrition has been found to not only influence maternal health, but also birth outcomes.

Importance of nutrition during pregnancy for maternal nutrition and birth outcomes

Studies have shown that access to maternal healthcare and adequate nutrition are beneficial to prevent maternal mortality during pregnancy.[6-10] Maternal healthcare globally includes the following: antenatal care visits (including consultation on vitamin and mineral supplement intake), facility-based delivery system, treatment for pregnancy complications, and postnatal care.[11-13]

Adequate nutrition is a vital element for healthy pregnancy and birth outcomes.[14] Research has shown that suboptimal maternal nutritional status at conception, during pregnancy, and early

infancy can lead to poor fetal growth and risk of disease development.[15] While fetal development depends on maternal nutrition, during limited nutrition intake or nutrient deficiencies, the placenta may limit the nutrients available to the fetus to maximize the mother's long-term reproduction potential.[15] Micronutrient deficiencies, including iron, iodine, zinc, and folic acid, are one of the most concerning factors influencing maternal nutritional status.[16] These deficiencies are found primarily in low- and middle-income countries, where pregnant women are often unable to meet their micronutrient requirements through diet alone.[16]

Nutrition for birth outcomes

Lack of adequate maternal nutrition can lead to several negative birth outcomes, including birth defects, preterm birth, and low birth weight.[16] Birth defects, also known as congenital anomalies, are characterized as morphologic, functional, and biochemical molecular defects developing from conception until birth.[17] Neural tube defects, one type of abnormality driven by folic acid deficiency, can occur in the first few weeks after conception.[17] This defect affects the central nervous system, specifically the brain and spinal cord development.[17] There is minimal treatment for neural tube defects; thus, they often lead to death.[17] Birth defects affect approximately 6% of newborns globally,[18,19] 7% of newborns in Burkina Faso,[20] and 13% of newborns in Madagascar.[21]

In order to prevent neural tube defects, findings from research indicate that women globally should increase consumption of folate-rich foods such as leafy green vegetables, and consume folic acid supplements, two to three months before conception through three months after conception.[17] To complement supplementation efforts, many countries have implemented mandatory flour fortification with folic acid.[22] The folic acid fortification program started in the United States in January 1998. Over 70 countries have implemented the folic acid fortification

program[22] including Burkina Faso in 2010.[23]; however, Madagascar has not established a national policy on folic acid fortification.

Preterm birth, characterized as a live birth before 37 weeks of gestation, is one of the major contributors to neonatal mortality, accounting for 75% of all neonatal deaths.[24] Preterm death accounts for 18% of deaths among children under five years, while 35% occurs during the first 28 days of life.[24] Preterm birth has been attributed to poor maternal nutrition[25,26] affecting about 11% of the global population.[24] The rates of preterm birth vary significantly by geographic region, with the highest rates in Africa (11.9%) and North America (10.6%) and the lowest in Europe (6.2%).[25] Preterm birth affects 30% of deliveries in Burkina Faso[20] and 27% of deliveries in Madagascar,[21] more than twice the average for the African continent.

In addition to birth defects and preterm birth, another birth outcome influenced by maternal nutrition is low birth weight (LBW), defined as a newborn birth weight of less than 2,500 grams regardless of gestational age.[27] LBW has been attributed to premature birth or restricted growth in utero. LBW has been found to affect approximately 20% of deliveries worldwide, with 95.6% of the estimates concentrated in low- and middle-income countries.[27,28] The prevalence of children born with LBW in Burkina Faso and Madagascar are 13.4% and 16%, respectively.[28,29] Children with LBW are at higher risk of early death and illness over the course of their lives.[27]

Cumulatively, maintaining an optimal nutritional status is critical during pregnancy to increase the likelihood of safe and healthy birth outcomes for both the mother and child.[16] To mitigate the risk of the birth outcomes mentioned above, it is recommended that pregnant women follow a balanced diet rich in fruits, vegetables, high-quality carbohydrates, and a variety of proteins[15] in addition to recommended supplementation regimens. In order to ensure adequate

dietary intake during pregnancy, it is helpful to first understand factors driving suboptimal nutrition in a particular population.

Factors influencing lack of optimal maternal nutrition

Many factors can influence poor nutrition during pregnancy. Recognizing and understanding these factors can ensure that women consume the proper nutrients during pregnancy and avoid the above-mentioned suboptimal health outcomes. Sociocultural factors such as food taboos, food aversion, and financial constraints have been found to influence dietary intake during pregnancy in similar contexts to Burkina Faso and Madagascar.[30-32] For example, a mixed-method study conducted in South Africa highlighted cultural beliefs and food taboos as major influencing factors that prevent women from consuming certain foods.[30] Chakona and Shackleton found that women refused to consume beans during pregnancy because they perceived it could negatively impact the baby's health (i.e., develop a sinus infection).[30] Additional food taboos included eggs, oranges, chicken, potatoes, and fish.[30] A similar qualitative study conducted in northern Ghana explored cultural and community perceptions of optimal diet for maternal and child health. Dalaba et al., found that food taboos often prevented women from meeting their recommended nutritional intake during pregnancy.[31] For example, participants highlighted the proscription of egg consumption during pregnancy as highly prevalent in the community because of the normative belief that the child might become a thief.[31] In addition to cultural perceptions, the authors also found that economic constraint was a common theme that influenced food choices during pregnancy.[31]

In a mixed-method analysis assessing whether pregnant women exhibited different food and nutrient intake patterns, compared with non-pregnant women in Burkina Faso, Huybregts et al., found that women during pregnancy often developed loss of appetite and nausea, which

influenced dietary intake.[32] The authors also cited specific financial constraints and food avoidances to mitigate perceived side effects.[32] For example, okra was perceived to induce vomiting, while mango was perceived to result in diarrhea. These cultural factors were found to influence nutrition during pregnancy. In addition to cultural influences, a qualitative study in Niger explored maternal food consumption practices and their underlying determinants during pregnancy.[33] Participants noted that food availability, food access, financial constraints, food aversion, and women's limited decision-making authority in household food purchase influenced women's ability to consume adequate nutrition[33]. As highlighted in the study by Rosen et al., decision-making and autonomy are key underlying factors to consuming a nutritious diet.[33]

Measurement of women's decision-making autonomy

To understand woman's autonomy, studies have focused on the element of decision-making. Many studies exploring women's decision-making autonomy on a global scale have aimed explicitly at health decision-making rather than nutrition decision-making.[34] These studies have indicated a positive relationship between decision-making autonomy and better health outcomes.[8] Previous studies have relied primarily on a set of 3 standardized questions (Figure 1) within the Demographic and Health Surveys (DHS) to assess women's decision-making autonomy, which covers decisions regarding healthcare, large household purchases, and visits to family or relatives.

DHS decision-making autonomy scale

Who usually makes decisions about:
1) Own health care.
2) Large household purchases.
3) Visits to family or relatives.

Response choice
Woman alone, husband alone, jointly with husband, jointly with someone else, someone else

Figure 1: DHS items capturing women's decision-making autonomy

Although widely utilized, the scale aims to capture some, but not all of the above-mentioned factors.[13] In the women's decision-making autonomy scale developed by the DHS, women are asked a few questions related to decision-making. For example, *who makes the final decision regarding your own healthcare?* Response options generally include women alone, husband or partner alone, jointly between wife and husband, partner, or someone else, and someone else alone.[35-37] Several studies have aimed to understand how women's level of decision-making autonomy predicts maternal healthcare utilization.[9,38,39] Most research has used the woman's decision-making autonomy scale from the DHS national survey[9,38,39] or a modified, contextually specific version. [40,41] In Madagascar and Burkina Faso, the original DHS decision-making scale has been used to measure women's decision-making autonomy in the 2005, 2010, and 2012 DHS reports.[2,35,42] However, as noted in a literature review by Osamor and Grady, although widely used throughout many countries, the internal validity and the item measures used for the DHS decision-making autonomy scale remain uncertain.[34] The uncertainty primarily stems from questions that may not adequately capture the complexity of women's decision-making autonomy.[34] However, many researchers have sought to further define the complexity of women's decision-making autonomy.

Understanding decision-making as a construct of autonomy

Autonomy is broadly defined as a static concept signifying independence.[43] There are no universally agreed-upon definitions of autonomy[13] as it is a context-specific construct. Therefore, it is often difficult to measure and compare autonomy between contexts due to its multidimensional nature and various definitions.[44] Nonetheless, researchers often use decision-making control as a proxy for autonomy.[45] For example, Senarath and Gunarwardena define women's autonomy related to healthcare and household decisions as the proportion of women who make decisions alone, jointly with their husband, or with someone else.[46] Meanwhile, in other contexts such as India, autonomy is defined as the capacity and freedom to act independently (ability to go to places such as the markets and health facilities, make decisions on contraceptive use, or household purchases without asking for permission).[47] Lastly, Dyson and Moore define the term as the ability to technologically, socially, and psychologically obtain information and use it as the basis to make decisions about one's concerns.[48] Despite the differences in the definition of women's autonomy, there is a similarity across contexts which is the ability for women to participate in decision-making. These decisions can often be made either solely or jointly.

Sole decision-making

Sole decision-making autonomy is characterized as one's ability to make their own decisions independently.[49] Seymour and Peterman have noted that women who solely made decisions were classified to have a high level of autonomy.[36] On the contrary, when decisions were made by a woman's partner, husband, or someone else, that signified that the woman has low levels of autonomy.[36] The rate at which sole decisions are made, compared to joint decisions, depends on specific decision domains.[50] For example, in a 2018 study conducted in Bangladesh and Ghana, Seymour et al., found that sole decisions among women in Bangladesh were more

likely to be made as decisions became more personal (i.e., own health problems, expression of religion, daily tasks, and family planning).[50] However, not all decisions are made alone, some involve more than one person.

Joint decision-making

Joint decision-making autonomy is characterized as a critical part of family life, particularly within marital relationships, when two individuals partake in decision-making.[49] The demographics health survey generally defines joint decision-making as when a woman participates in decision-making with her husband and/or someone else.[50,51] In addition to a woman's ability to make her own decisions independently, joint decision-making has also been interpreted as women having a high level of autonomy.[51] A prime example of joint decision-making is within the realm of marital or intimate relations. Osamor and Grady suggest that joint decision-making is the best form of decision-making autonomy because it allows couples to make decisions based on communicating their perspective to each other and deciding on what works for them.[49] For example, if a couple is discussing a decision regarding a woman's healthcare, this would be considered a joint decision. Specifically, this decision would be viewed as a joint decision based on three elements: intentionality (the agent intends to perform the action), understanding (the agent understands the action he or she is choosing), and lack of external control (the agent is not controlled by another person), especially without one party imposing their preference on or being controlled by the other.[49]

However, several studies using women's decision-making autonomy have defined a woman as autonomous if she can make her own decisions or joint decisions with her partner.[34] However, research has shown that joint decision-making can often be a false representation of power dynamics in the household.[52] For instance, if a woman makes a joint decision with her

spouse, yet a dispute or decision that goes against that of her partner's preference arises, then the decision can favor the husband. Thus, although such a decision is jointly made, in some instances, one party may always be favored over the other, highlighting the dynamic and multi-faceted nature of decision-making, autonomy, and power between couples.

Other complexities present within couples' joint decision-making may or may not classify a woman as "autonomous." For example, Osamor and Grady developed a continuum of couple's joint decision-making for women's healthcare (Figure 2). They suggested the following continuum, below, must be true to conclude that a woman meets the ethical standards of an acceptably autonomous decision-making individual.[49] Meanwhile, a woman does not meet the standards of being autonomous if the man makes decisions, then communicates these to the woman, and the woman accepts.[49]

- *Both individuals are equal partners, understand the decision being made, intend to make it, they share decisions, and support each other.*
- *Depending on the issue, one partner might have more power in decision-making than the other. But they are still able to make decisions jointly as long as the "less" dominant partner has enough understanding and intentionality and does not view herself as disempowered.*
- *There is a preference and values by women in certain societies: some women prefer to jointly make decisions with partners or rely on him for decision-making, rather than individually make decisions herself.*

Figure 2: The continuum of couple's joint decision-making for women's healthcare

It is also imperative to consider multiple factors including cultural, ethnic, and religious in order to understand a woman's autonomy level as it relates to couples' joint decision-making.[49] In a report examining the participation of women in household decision-making, Kishor and Subaiya found that joint decision-making was cited one or more times by women in 13 out of 23 countries in the sample.[51] Joint decisions focused on large household purchases or visitation to family or friends.[51] Joint decisions are made differently and thus, should be studied differently during disagreements. One study examining intrahousehold decision-making autonomy in Bangladesh and Ghana found that during disagreements, women were more likely to report decisions as jointly made, whereas, men were likely to report decisions as solely made.[50] By examining the complex role of decision-making autonomy, researchers are able to best understand how it factors into various domains such as health and nutrition outcomes.

Women's decision-making autonomy on health behaviors and nutrition outcomes

Decision-making autonomy is an important factor contributing to maternal healthcare utilization and nutrition.[34,53,54] Specifically, lack of permission to seek healthcare without a household member's consent, a critical factor limiting healthcare utilization, has been negatively associated with women's decision-making autonomy.[8] Multiple studies throughout low- and middle-income countries, including Ghana, India, and Nigeria, have utilized the construct of women decision-making autonomy to understand health behavior and nutrition outcomes. For example, in a qualitative study examining reasons pregnant women delay seeking maternal healthcare during delivery in Ghana in 2019, Sumankuuro et al. listed lack of permission to seek healthcare as a key contributor, which can result in high levels of maternal mortality.[55]

Furthermore, studies have shown that women are often not the primary and/or sole decision maker to seek healthcare services.[36,37,56] For example, in a nationally representative survey sample,

conducted in Nigeria in 2018, Osamor and Grady noted that 6.2% of women reported making their own decisions about healthcare, whereas 32.7% jointly made healthcare decisions with their husbands/partners, while the majority, 61.1% of women had healthcare decisions made for them by their husbands/partners.[56] It is also important to note that, regional variation influenced the findings. Specifically, over 80% of women in the North Western part of Nigeria were more likely to have decisions made by husbands/partners alone, compared to less than 30% of women in the South Western part of Nigeria.[56]

In another study conducted in Nigeria, examining the patterns of women's decision-making autonomy and antenatal care utilization, Obasohan and colleagues found that approximately 40% of women were categorized as autonomous when deciding on issues related to their health, large household purchases, and visits outside the house.[37] Additionally, approximately 60% of women were classified as not autonomous.[37] The authors also noted a positive association between decision-making autonomy and antenatal care utilization.[37] Similarly, in Nepal, Adhikari (2016) reported that 62% of women were not involved in all three-household decision-making processes (deciding on their own healthcare, making major household purchases, and visits to family or relatives).[36] The authors found out that maternal healthcare utilization is significantly higher among women with greater decision-making autonomy regarding household activities, compared to those whith less decision-making autonomy in this area.[36]

In addition to women's decision-making autonomy influencing maternal healthcare seeking behaviors, researchers have also noted how the construct influences nutrition outcomes, particularly for children.[57] In a literature review published in 2015 by Carlson et al., women's autonomy was associated with improvements in children's nutritional status.[58] Similarly, a study conducted in India in 2009 showed that women who have autonomy over financial and physical

decision-making, were less likely to have stunted children.[59] A similar study in Ghana, noted that women who had high levels of autonomy in decision-making, freedom of movement (ability to travel outside of the house), and financial autonomy were more likely to meet minimum acceptable diet requirements when feeding their children.[60] Furthermore, high women's autonomy was found to be protective against stunting after controlling for age and gender. In another study conducted in northern Kenya, among a traditionally nomadic pastoralist population, Brunson et al., in 2009, found an association between greater levels of women's autonomy and improved nutrition among children, ages 3-10 years old.[61]

Many studies have focused primarily on examining women's decision-making autonomy from a healthcare utilization perspective or children's nutritional outcomes.[6,39,62] However, women's nutrition decision-making during pregnancy remains poorly understood. As a result, it is important to understand how women's decision-making during pregnancy influences nutrition choices. As part of a larger study, this study will explore the relationship of nutrition decision-making during pregnancy in Madagascar and Burkina Faso.

Women's decision-making autonomy in Burkina Faso

Burkina Faso is characterized as a patriarchal male-dominated polygamous society, where men hold most of the decision-making power.[63] In most cases, while husbands and wives do make income-related decisions together, men ultimately make the final decision.[64] Wives also do not typically know of their husband's income, while husbands are usually aware of their wives' income. Decision-making power often holds different values based on rank, age, gender, and lineage.[63] For example, older men have more decision-making power than younger men, and men have higher decision-making power than women.[63] This disparity in decision-making stems from a variety of sociocultural factors such as ownership of land and lineage.[63]

This disparity is also viewed in land ownership which has been found to favor men over women.[65] For example, women are viewed more as "owners of crops", as opposed to "owners of land".[65] In other words, women have the right to cultivate crops, but they do not have the right to allocate or own land. This is further displayed during the practice of levirate.[66] This practice mandates that widows marry their brother-in-law to secure custody of their male children and failure to do so will transfer custody rights automatically to the deceased husband's family.[66] Despite the illegitimacy of levirate by the government, it is still widely practiced throughout the country, which makes widows particularly vulnerable. This can create unequal power and financial dynamics.[66] Understanding these context specific gender norms gives researchers more insight on decision-making autonomy.

In fact, most Burkinabe live in a patrilineal society, with the father's line recognized as kinship, where children follow the man's lineage.[66,67] That said, in the west and southwest region, some Burkinabe subscribe to the matrilineal lineage. The patrilineal structured often makes male children more preferred at birth than female children, as the sons will continue the family lineage, meanwhile, girls will leave once they are married.[67] Gender norms demonstrate preference towards male children at a young age.[68] Conversely, girls are trained by their mothers to look after children, assist in food preparation, and other household chores to prepare them for marriage. Boys are often trained by their fathers to work on the fields. [67]

It is important to understand the generalizability of decision-making autonomy among women throughout Burkina Faso. Three nationwide surveys were conducted across Burkina Faso in 2003, 2010, and 2020.[35] Based on the 2010 survey, women were asked each of the items from the DHS scale regarding decision-making. Approximately 20% decided alone or jointly with their husbands or partners with regard to women's own healthcare and food purchases. An

overwhelming amount of the decisions (over 75%) were made by their husbands, partners, or someone else. However, regarding the ability to visit families, women made the decision independently or jointly 52.3% of the time. In addition, 88% of women in unions, who made their own money, independently decided how to utilize it.[35] The 2020 survey report remains pending.

Some studies have been conducted to understand women's decision-making autonomy around factors including maternal healthcare seeking behavior and domestic violence.[69,70] Pambe et al. in 2014 aimed to explore how socioeconomic characteristics shape decision-making in the household and the experience of domestic violence (i.e., psychological pressure, emotional violence, physical violence, and sexual violence).[70] Using the DHS data set, the authors reported that women with a higher education level were more likely to participate in all three types of decisions (own healthcare, major household purchases, and visits to family or relatives). In addition, women who were paid for work or were older, were more likely to participate in decisions.

In addition, a qualitative study was conducted by Samb and Ridde in 2018 to examine the impact of free healthcare interventions on women's capability in three health districts.[71] A combination of semi-structured interviews from pregnant or lactating women, health workers, and COGES members (community-based management committees), and documentary analysis were utilized. Women noted greater decision-making power because of free healthcare.[71] Consequently, women did not rely on the husband's finances to seek healthcare. As a result, there was an improvement in women's negotiating power in decisions. Despite removing financial barriers, women still faced challenges with contraceptive use. Although participants highlighted interest in using contraceptives, usage remained low due to their husband's disapproval. Thus, demonstrating the barriers in decision-making autonomy women face even when financial barriers were removed.

Women's decision-making autonomy in Madagascar

Women's decision-making autonomy is also an important point of consideration in Madagascar, especially because research has found that there are inequalities present among genders.[72] Boys are taught to make decisions about growing up and expanding the family, meanwhile girls are taught to comply with their husbands' preferences and are beholden to their husbands' family.[72] When asked about decision-making, men responded that women have a role in group decision-making, conversely, women disagreed with that statement. Generally, men's decisions are considered important as such decisions involve agriculture and income utilization.[73] Women make decisions about crop management and household expenses. Men are more respected and likely to make decisions more than women of the same age.[73,74] Meanwhile, older women and grandmothers are respected and have a role of giving advice to younger men.[73] Overall, while there have been matriarchal tribes such as the Tanala, in most tribes, men generally dominate decision-making.[73]

While agriculture is the most dominant profession for both genders, cultural norms determine tasks that men are more likely to work on. This includes in some contexts tasks considered to be labor-intensive such as cultivating rice, cassava, cattle, and soil preparation, for higher pay[75]. Meanwhile, women, who are often responsible for cultivating legumes for family consumption, weeding, transplanting, household work and childcare, are offered low paying jobs.[72,75] Thus, women's labor is undervalued compared to their male counterparts. Furthermore, in times of economic hardships or emergencies, women's savings are likely to be spent first, resulting in limiting women's economic and financial independence.[72] It is also important to note that 22% of households in Madagascar are headed by women, 65% of which are single mothers, and these households are often faced with economic and social disadvantages compared to their

counterparts.[72] Lastly, women and girls are more likely to spend time accessing health services for themselves and others compared to their male counterparts.[72] Despite this fact, males, in parts of Madagascar, have control and decision-making power over how household finances are spent on healthcare.[72]

Similar to Burkina Faso, Madagascar started collecting decision-making autonomy questions from the DHS in 1997 to understand women's autonomy, specifically financial autonomy.[76] The survey focused on individuals who make decisions regarding the utilization of women's incomes. Women highlighted that 80% of them made the decision either independently or jointly with their partner. Precisely, 44% of women independently decided while 36% jointly decided.[76] From 2003-2004 a similar survey was carried out with more robust questions as mentioned in previous paragraphs[42]. Women were asked who makes decisions regarding their own healthcare, daily food to cook, and visits to family or friends. Over 82% of married women noted making decisions independently or jointly with their husband or partner.[42] However, among non-married women, approximately 50% made decisions independently or jointly with someone else; while the remainder 50% had decisions made for them by someone else. Although there was a small improvement when compared to the 1997 results, with the addition of the household item tasks listed above, it was noted that women decided either independently or with their partners 89.4% of the time with regard to the family revenues.[42]

The most current report was a nationwide survey conducted across Madagascar in 2008-2009.[2] Researchers found that among the items asked to measure women's decision-making autonomy such as: women's own healthcare and visits to family members, over 80% of women responded that decisions were made either independently, or jointly with their husbands or partners. In relation to use of women's revenue, over 90% reported deciding independently or

jointly with husband or someone else. A recent survey was conducted in 2020, results of this report are pending.

To our knowledge, no study has specifically explored nutrition decision-making autonomy among women during pregnancy in either Madagascar or Burkina Faso, two contexts where maternal nutrition intake is sub-optimal relative to regional and global benchmarks.[77,78] Understanding this phenomenon is important because it can elucidate contributing factors that influence women's nutrition choices during pregnancy, a critical life stage for maternal and child health outcomes. Therefore, this study's objective is to understand the factors that may influence women's decision-making autonomy during pregnancy in Madagascar and Burkina Faso. To understand factors influencing women's nutrition decision-making, the food choice process model was utilized to frame the analytical process.[79]

Food choice process model to understand influencing factors of nutrition decision-making

Several conceptual models have been utilized in the literature to understand factors affecting food choices since the 1990s.[80] Some authors have discussed food choice models and the multifaceted mechanisms that influence food decision-making.[81,82] For example, in 1997, Steenkamp published a conceptual model for consumer behavior with respect to food.[81] This model distinguishes the consumer's decision process with respect to foods and the factors influencing the decision process, some of which include properties of food, personal related factors, and environmental factors. In 2009, Ness and Marreiros published another conceptual framework of consumer food choice behavior which highlighted processes of consumers' decision-making and quality perception, integrating constructs of the total food quality model of Grunert and models of Engel, Blackwell, and Miniard.[82]

Despite the wide array of food choice models, the food choice process model by Furst and colleagues was chosen because it displays a broad range of factors and types of processes which facilitates the understanding of how people make food choices (Figure 3).[79]

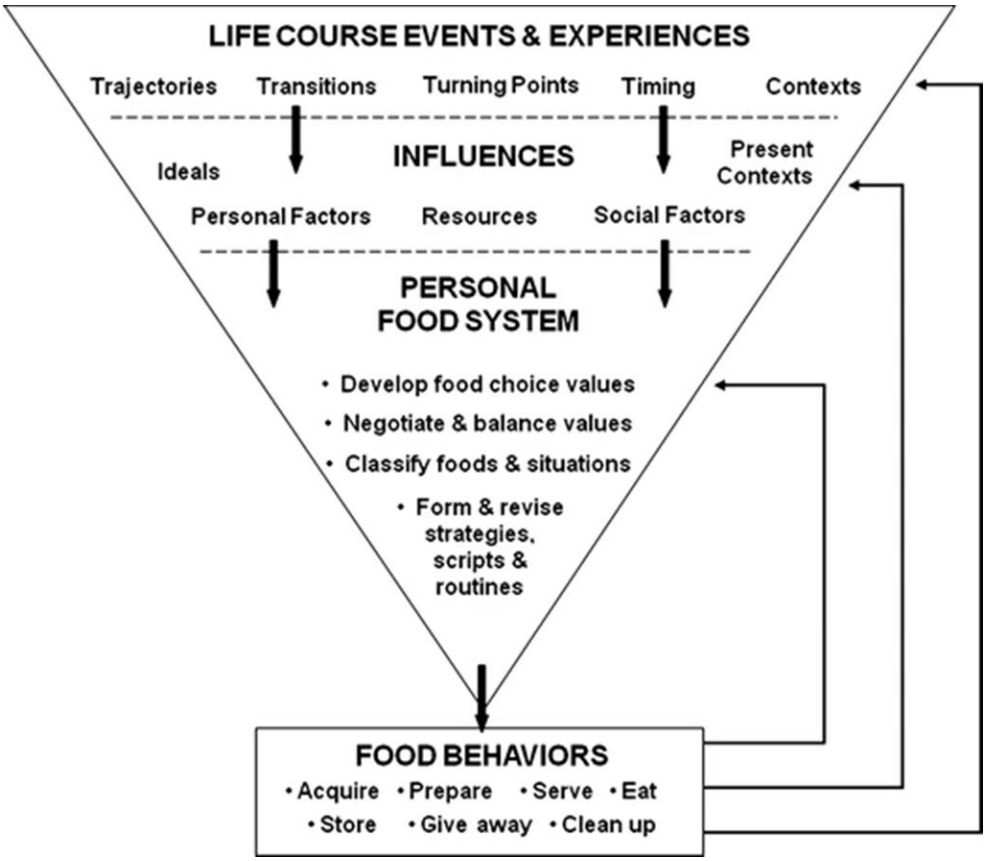

Figure 3: Food choice process model

The food choice process model was inductively sought from adults during in-depth quality interviews.[83] The model represents different types of factors and processes in a single choice event. The food choice process model contains three broad components: life course, influences, and personal system,[79] all of which shapes individuals' final decisions.

The life course involves personal roles, social, cultural, and physical environments to which an individual has been exposed.[79] Across the life course the model ascertains a series of influencers including ideals, personal factors, resources, social framework, and food context. These influences are conceptualized to interact and shape one's personal systems, thus resulting in an individual's ability to make food related choices. In addition, the food choice process model assesses factors influencing food decision-making and emphasizes the relationship within the factors and indicated pathways that could contribute to their final food choice.

Various studies have utilized the food choice process model derived by Furst et al., to understand factors influencing food choices among adolescents and young adults, and women in countries such as the United States, Thailand, and India.[84] [85,86,87,88] Nonetheless, to our knowledge, no study has used the food choice process model to examine influencing factors of nutrition decision-making autonomy among women during pregnancy in Burkina Faso and Madagascar. As such, this study aims to:

Aim 1: To understand the extent to which women have nutrition decision-making autonomy over what they consume during pregnancy in Burkina Faso and Madagascar.

a. What do women typically consume during pregnancy in these settings?
b. What factors influence how pregnant women make decisions about what they consume?
c. To what extent do women have decision-making autonomy over what they consume during pregnancy?

Aim 2: Compare and contrast factors that influence women's decision-making autonomy over nutrition choices in Burkina Faso and Madagascar

a. How do the influencing factors of decision-making over nutrition choices compare between settings?
b. How do the influencing factors of decision-making over nutrition choices contrast between settings?

Chapter 2: Methods

Study settings

Burkina Faso

Burkina Faso is a landlocked country situated in West Africa, bordered by Mali, Niger, Ghana, Benin, Ivory Coast and Togo (Figure 4).[89] It is made up of 13 regions, with 45 provinces within, comprised of communes.[90] Burkina Faso, also previously known as Upper Volta, gained its independence in 1960 from France.[91] As of 2019, Burkina Faso currently has a gross domestic product growth (GDP) annual rate of 5.7%, at nearly 16 billion USD.[92] The GDP rate is compared to the United States, which holds the highest rate at 21.43 trillion USD.[93] According to UNESCO in 2018, 49.2% and 31% of males and females, respectively, over the age of 15 years were literate.[94] Based on the Global Gender Gap Index by the World Economic Forum which examines countries improving gender inequality, Burkina Faso ranks 129 out of 195 countries.[95]

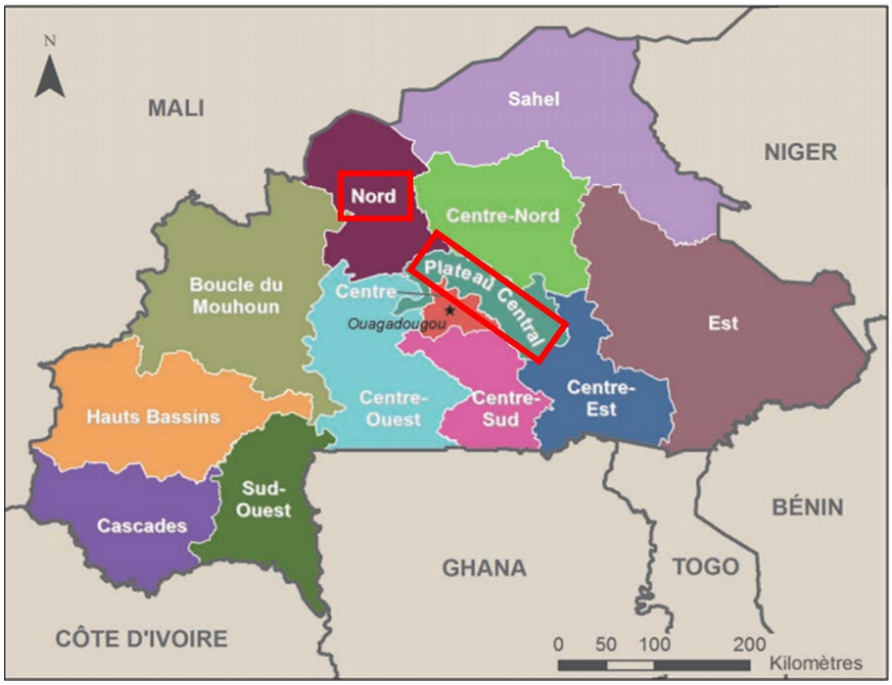

Figure 4: A map of Burkina Faso

As of 2020, Burkina Faso had a population of approximately 21 million people.[96] The country has a young demographic, with more than 65% under the age of 25 years old.[96] Most Burkinabe reside in rural areas (71%), while 29% live in urban or peri-urban communities.[96] Burkina Faso has approximately 60 ethnic groups, with major groups including: Mossi, Fulani, and Gurma.[68,89,97] More than half of the country identifies as Muslim (61.6%), followed by Christian (29.9%), while traditional beliefs are practiced by 7.3% of the population.[89]

Burkina Faso has one the highest rates of infant mortality, ranked 21st globally, with a rate of 52 deaths/1000 live births.[96] To put this rank into perspective, Iceland has the lowest infant mortality at 2 deaths/1000 live births, and Central Africa Republic has the highest infant mortality at 81 deaths/1000 live births.[98] The country is faced with a continuous burden of diseases including chronic malnutrition, which affects a large portion of the population, with nearly 16% and 21% of children under 5 years old underweight and stunted, respectively.[99] The WHO-UNICEF technical expert advisory group has rated the 21% stunting as high.[100] Additionally, nearly two-thirds of pregnant women 15 – 49 years old in Burkina Faso have anemia.[101]

Considering the elevated rates of malnutrition, this formative study was conducted in Yako and Ziniare health districts. Yako is located in the Passore province in the Nord region, with 22,904 people;[102] while Ziniare is situated in the Oubritenga province in the plateau central region, with about 44,353 people.[103]

In Yako and Ziniare, the region is primarily dominated by the Mossi ethnic group. The Mossi group have "the most centralized and hierarchical political system" in the country since pre-colonial time.[66] The Mossi people speak Moore and have a high rate of labor migration to neighboring countries such as Ghana and Cote d'Ivoire. The Mossi group practices multiple religions including traditional religion, Islam, and Christianity.[104] The Mossi are generally farmers

who grow staple crops such as millet and sorghum.[104] Rural communities dominated by the Mossi group often comprise of the extended-family compound. The typical Mossi family compound is made up of his younger brothers, married sons, their wives, and children.[105]

Additionally in Yako, the second largest group are the Fulani. The ethnic Fulani tribe speak Fula, and they commonly practice Islam.[106] The Fulani tribe have historically been known as a nomadic ethnic group throughout West Africa. Arranged marriage, among Fulanis, is frequent, and marriage among family members (e.g.: cousins) and other intralieneage is common.[106] Most men practice polygamy with the typical household unit comprising of the family head, his wives, and his unmarried children.[106]

Madagascar

Madagascar is an island in sub-Saharan Africa located in the Southeastern Africa region, east of Mozambique (Figure 5).[96,107,108] The country is divided into 22 regions, with 119 districts. Madagascar gained independence in 1960 from France after which the country switched its official language from French to Malagasy.[109] As of 2019, Madgascar has a GDP annual rate of 4.9%, at 14 billion USD.[110] In regard to literacy, about 75% of the population over 15 years and older are literate, with about 77% and 72% among males and females, respectively.[111] As of 2020, the Global Gender Gap Index to track and understand how countries are improving gender inequality ranked Madagascar 62 out of 195 countries.[95]

Figure 5: A map of Madagascar

As of 2020, the population was comprised of over 27 million individuals, largely made up of young people under 15 years old (42%) and children under 5 years old (18%); just 4.5% of the population is pregnant women.[96,108] Most Malagasy people live in rural areas (70%).[107] Over 90% of the population identify as Malagasy, which includes about 20 ethnic groups.[107] The largest ethnic group is the Merina (known as "the elevated people") followed by Betsimisaraka (known as "the inseparable multitude").[96] Madagascar is predominantly Christian (47%) and those following traditional beliefs (42%).[107]

Madagascar has one of the highest malnutrition rates in the world. The infant mortality rate is high (37.8 deaths/1000 live births), which ranks Madagascar 42nd in the world.[96] Child malnutrition in Madagascar is prevalent among children under 5 years old, with stunting affecting 47.3% of children and wasting among 8.2% of children.[112] Meanwhile, 26.7% of women of

reproductive age are affected by malnutrition.[113] Micronutrient deficiencies are a persistent challenge nationally: among pregnant women, aged 15 - 49 years, 35.6% have anemia.[101]

Due to the persistent cases of malnutrition, this study was conducted in two districts of Madagascar: Ifanadiana and Soavinandriana. Ifanadiana is located in Vatovavy-Fitovinany, in the southeastern part of the country, comprised of 215,000 people.[114,115] Soavinandriana is located in Itasy, the central highland part of the country, with a population of about 264,000.[115]

In the Southeastern region, there are 5 main ethnic groups: Taisaka, Antaimoro, Zafisoro, Taifasy, and Tamabahoaka. To elaborate on a few, Antaimoro "the people of the coast" were the only group to know how to write in Madagascar, prior to the arrival of London missionary society.[116] The Antaimoro group speak Malagasy and are of Indian and Arabic origins, while others identify as indigenous, with a small minority actively practicing Islam.[117] This group lives near river valleys. As such, women are often responsible for fishing in streams or shores, while men travel to open waters.[117]

The central highlands' region is primarily dominated by two ethnic groups: the Merina and Betsileo.[116] Merina, also known as "those from the country where one can see far," are perceived as the most "Asian" among the Malagasy ethnic groups, with many similar features as those of southeast Asia.[118] The Merina ethnic group also speak a dialect of Malagasy.[119] They are the most populous ethnic group in the region, and hold important roles in the social, economic, and political structures of Madagascar.[119] The Merina group make up a significant portion of the educated middle class such as serving as businessmen and government officials. In addition, the people of Merina cultivate rice, cassava, potatoes, onions, cattles, and pigs.[119] Meanwhile the Betsileo mostly live in the central highlands and speak a dialect of Malagasy.[120] The Merina are productive cultivators of rice, as well as cassava, corn, yams, banana, and sugarcane, and are considered the

best farmers in the country.[116] Other people of the Merina group are also carpenters, bricklayers, and merchants or government employees.[120]

Research design

The proposed study is part of a larger mixed methods formative study aiming to develop social and behavioral strategies to introduce multiple micronutrient supplements (MMS) in each setting.[121] This sub-study was added to the parent study to examine women's decision-making autonomy in Burkina Faso and Madagascar. The study was conducted using data from phases 1 and 2 of the parent study, from October 2020 to December 2020, drawing specifically from focus group discussions among pregnant and lactating women during phase 1 and semi-structured interviews with pregnant women, and free list data with women of reproductive age, in phase 2 (Figure 6). Focus group discussions, semi-structured interviews, and free list data were utilized as a form of methodological triangulation. Creswell, Miles, and Patton recommend triangulating multiple methods to allow for corroboration of evidence to enhance the quality of the analysis and thus improve the overall credibility of results.[122-124] In addition to methodological triangulation, this study collected data from different locations (i.e., two districts in Burkina Faso and 2 districts in Madagascar) and used elements of the food choice model framework for triangulation.

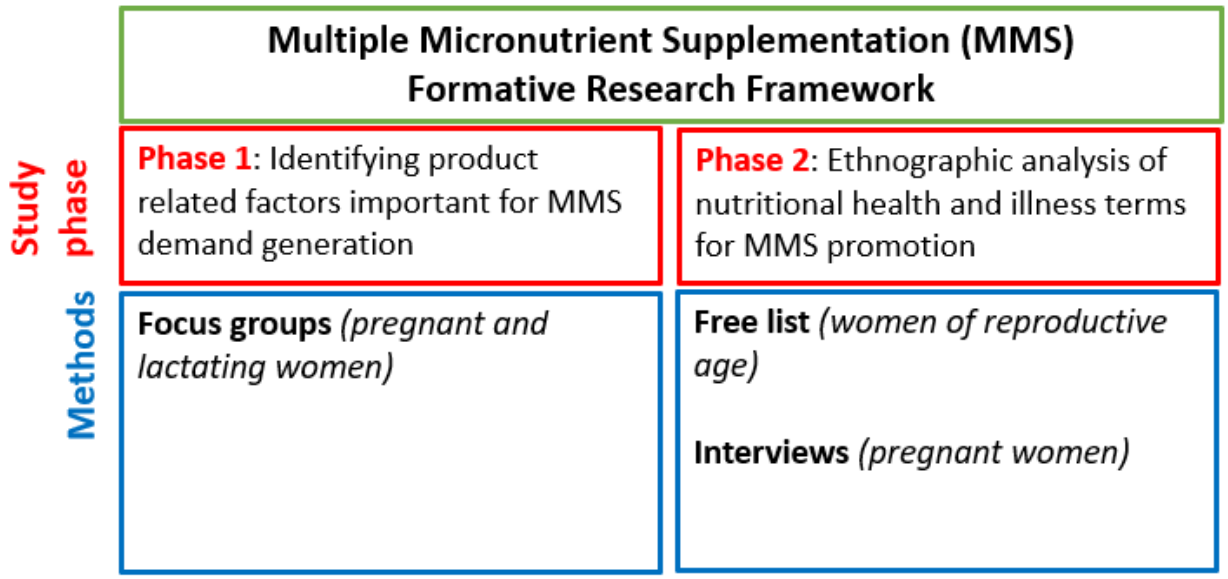

Figure 6**:** MMS Formative Research Framework

Data collection methods

This sub-study utilized focus group discussions among pregnant and lactating women, semi-structured interviews among pregnant women, and free lists among all women of reproductive age.

Focus group discussions

A focus group discussion is a qualitative method where group discussion is facilitated by a moderator who asks questions to solicit responses.[125] They are particularly helpful for understanding social norms and issues given the public nature of the discussion.[125] They also facilitate understanding of group norms by observing group interaction.[126] Focus group discussions are led by a moderator who uses a semi-structured discussion guide with open-ended questions and more specific follow-up probes. The discussion guide in this study is comprised of 10 questions that were added to highlight nutrition-related information, responsibilities, and decision-making at the community level (Appendices A-B). Typically, these discussions involve six to twelve participants to ensure a size adequate for discussion but also one that can be managed by the moderator.[127] Depending on the research topic, it is also recommended that the sample of

participants be homogeneous with factors including community role, socio-economic status, and ethnicity.[128]

Sampling procedures

Participants were purposefully restricted to the first 6 to 10 participants for focus groups if they met inclusion criteria and/or were recommended by other community members (e.g., health workers, leader, etc.), who identified participants that would provide rich information about nutrition-related decision-making during pregnancy.[122,129]

In Burkina Faso and Madagascar, participants were included in the focus group discussion sampling if they were between the ages of 18 to 49 years old and lived in the selected districts where the study was aimed to take place (Yako and Ziniare in Burkina Faso, or Itasy and Vatovavy Fitovinany in Madagascar).

Semi-structured interviews

In addition to focus group discussions, semi-structured interviews are well suited for gaining deeper insights into social phenomena as described by individuals.[130] Semi-structured interviews are conducted between an interviewer and a participant, usually in the privacy of one's home or another comfortable location.[131] Interviews in this study were guided by a semi-structured interview guide with open-ended questions. The interview guide questions were designed to answer the research questions.[132] In addition, the interview guide allows the interviewer the flexibility to improvise specific follow-up questions, and give space for participants to provide verbal expressions.[131] Semi-structured interviews were used in this study to solicit in-depth stories, narratives, and explanations from individual participants based on a semi-structured guide. This interview guide focused on understanding individual level perceptions about women's decision-making during pregnancy (Appendices C-D).[131]

Sampling procedures

Participants were purposefully recruited for semi-structured interviews, in both countries, if they were pregnant, between the ages of 18 to 49 years old, and lived in the selected districts where the study was aimed to take place (Yako and Ziniare in Burkina Faso, or Itasy and Vatovavy Fitovinany in Madagascar).

For each country setting, a total of 24 pregnant women were sampled using semi-structured interviews, a number which is recommended to reach 'data saturation' of key themes.[122] Two interviews (one in Ziniare and one in Yako) were not recorded; consequently, they were omitted from the sample.

Free list

Free listing is a type of cultural domain analysis to understand how people in a community think. [133] Free list data collection was done to identify a list of local food items consumed or not consumed by pregnant women within each community. This method was used to elucidate two points, 1) the most salient foods consumed by women during pregnancy, and 2) foods that are categorized as prescribed and proscribed. Food proscriptions are defined as foods that are classified as forbidden for pregnant women to consume within a community. Meanwhile, food prescription is defined as foods that are perceived as good for women to consume during pregnancy in the community. The free list data included a list of structured questions such as list of commonly consumed foods in the community during pregnancy, and probes to explain why it was consumed or not consumed (Appendix E). Participants' responses to probes were categorized as free list fieldnotes.

Sampling procedure

Participants were purposefully sampled with the help of community health workers familiar with the communities in Burkina Faso and Madagascar. Participants were included in the sample if they were between the ages of 18 to 49 years old, and lived in the selected districts where the study was aimed to take place (Yako and Ziniare in Burkina Faso, or Itasy and Vatovavy Fitovinany in Madagascar). To conduct a free list data collection, Weller and Romney suggest a sample size minimum of 20 to 30 participants per cultural group.[133] Across both countries a range of 30 to 60 participants were sampled.

Semi-structured interviews, focus groups, and free lists data proposed sample sizes were predetermined from the parent study. Focus group sample sizes were determined based on Bernard et.al.'s, recommendation, and semi-structured interviews were based on previous literature suggesting at least 14 interviews, to ensure 'data saturation'.[122,134] Of note, the team emphasized larger samples of 20 to 40 interviews to reach data saturation.[134] However, data saturation was not assessed due to lag in transcript submissions from the data collection team. The sample sizes are outlined in Table 1 by method, participant type, and location.

Table 1. Sample sizes by country, method, and geographic unit

Country	Method	Sample Size (per district)		Total
Burkina Faso		**Yako**	**Ziniare**	
	Focus group*	3 focus groups	3 focus groups	6
	Semi-Structured Interview	11 interviews	11 interviews	22
	Free list	15 participants	15 participants	30
Madagascar		**Itasy**	**Vatovavy-Fitovinany**	
	Focus group*	3 groups	3 groups	6
	Semi-Structured Interview	12 interviews	12 interviews	24
	Free list	30 participants	30 participants	60

*Each focus group included between 6 – 16 pregnant or lactating women

Training and field workers

Local partners in Madagascar and Burkina Faso were trained by a lab at The Pennsylvania State University. The trainings of data collectors were conducted by the local co-investigator in Burkina Faso and by a non-governmental organization, in Madagascar. For each country, trainings were held through Zoom, due to COVID-19, over the course of a month. The training objective was developed to have local partners understand the purpose of each method, including focus group discussions and semi-structured interviews, conduct each method, and conduct data management for each method. Trainings were divided into phase 1 and phase 2 of the study. Upon completion of each training per site, data collection was staggered, with the Burkina Faso team beginning first and the Madagascar team beginning training once the Burkina Faso team was already collecting data.

Data management and analysis

Data management and analysis was conducted for two types of data including textual data for semi structured interviews and focus groups and cultural domain analysis for free list data.

Analysis of textual data

Textual data from focus groups and interviews were digitally recorded, translated, and transcribed from local languages (Malagasy in Madagascar; Moore in Burkina Faso) into French for analysis by data collectors. Transcripts were then uploaded into *Dedoose* software for data management and textual analysis[135]. A codebook was developed based on the interview guide contents, the guiding research aims, and elements of the food choice decision process model (Appendix F).

The codebook was initially divided into three broad indicators: nutrition related information, responsibilities, and decision-making. However, after discussion regarding how the categories relate to the research questions and potential overlap between codes, there was a consensus to modify the codes to the following: diets prior and during pregnancy, influencing factors on decision-making with regard to supplement and food choice, and decision-making with regard to supplement and food choices. A deductive approach was utilized to address the research objective. A deductive approach has a priori orienting concepts and propositions such as a theoretical framework to test or observe in the field.[123] Specific to this study, a deductive approach was undertaken by utilizing constructs of the food choice process model. This was coupled with occasional use of the inductive approach – researchers make observations and discover recurrent phenomena in the field and finds recurrent relations among them.[123]

The textual analysis of transcripts was conducted by one investigator, with consultation from advisors and other lab individuals, following a multi-step process. Firstly, themes and subthemes were developed deductively based on elements of the food choice decision process model and literatures. Secondly, transcripts were read in their entirety. Textual excerpts that help address prior mentioned research questions were tagged, allowing for emergent themes.[128] After being immersed in the focus group and semi-structured interview data, salient themes and sub-themes were identified for inclusion in the codebook. Thirdly, each theme and sub-theme was extracted from Dedoose for interpretation vis-à-vis the research questions and analytical framework. Fourthly, a pattern code map, as suggested by Miles in 2014, was developed to visualize, and see how the identified individual factors interconnected.[123] In other words, this process allowed us to look at themes of interconnectedness. Lastly, key findings were presented using tables, figures with primary themes, sub themes, and direct quotes that illustrate answers to the research questions.

Analysis of cultural domain data

Free list data were used to identify foods consumed by women during pregnancy, and list food items that participants categorized as food proscriptions and food prescriptions. To assess the top salient foods consumed during pregnancy, Visual Anthropac, a software program for conducting cultural domain analysis was utilized.[136] The software identifies saliency by accounting for both the frequency and rank of listed items. Items with the highest saliency value are those that respondents list most commonly and respondents tend to recall more immediately compared to other items.[137]

Chapter 3: Results

Describe the typical diets of women in Burkina Faso

In Burkina Faso, the typical meal of a woman during pregnancy primarily consists of carbohydrate-rich foods such as *tô* (millet or corn flour dough mix) and vegetable sauces (okra, baobab, boulvanka, sorrel sauce, eggplant sauce). Sometimes, participants also mentioned consuming fruits such as oranges and bananas and various soups (goat and fish).

Based on interview and free list data, participants most frequently discussed consuming *tô* during pregnancy (Table 2).

Table 2. Top 5 foods consumed by women during pregnancy in Burkina Faso

Local food term	**English term**	**Brief *emic* description of the term, from participant description perspective**	**Salience**
Sagbo/*tô*[*]	Flour dough mix	Thick and malleable paste made of cereal (e.g., sorghum, millet, or corn) by mixing flour with water and something sour like lemon or tamarin. It is mostly eaten with sauce and is available year round.	**0.789**
Moui[*]	Rice	White cereal that can be eaten with many sauces. It is tasty but not accessible to everyone.	**0.603**
Benga[*]	Beans	Food available year round. Generally consumed with cooking oil.	**0.393**
Nemdo	Meat	Good [for consumption] but not accessible to everyone.	**0.258**
Orange	Orange	Seasonal fruit	**0.234**

*These top 3 foods were salient in textual analysis

In addition to the widely consumed *tô*, women frequently mentioned consuming rice during pregnancy. Participants also discussed consuming beans during pregnancy; however, beans were less frequently consumed compared to rice and *tô*. To a lesser extent, participants mentioned consuming fruits including oranges and bananas, and consuming goat soups.

Describe the diet of women in Madagascar

In Madagascar, the typical meal of women during pregnancy consisted of rice and cassava. Sometimes women also listed consuming fruits such as banana and mango.

Based on interview and free list data, participants primarily mentioned consuming rice during pregnancy (Table 3).

Table 3. Top 5 foods consumed by women during pregnancy in Madagascar

Local food term	**English term**	**Brief *emic* description of the term, from participant description perspective**	**Salience**
Vary*	Rice	Dry rice (it is cooked until there is no water in the preparation). Women consume it to get energy and to be strong. Rice allows the fetus to be healthy.	**0.778**
Mangahazo*	Cassava	Cut into small pieces and put sugar. She [pregnant woman] doesn't feel very tired when she eats it. This food brings energy.	**0.688**
Akondro*	Banana	Provide vitamin and energy	**0.537**
Ovy	Potatoes	It is cooked in water. This food is consumed because it provides energy.	**0.475**
Manga	Mango	Provides vitamins	**0.346**

*These top 3 foods were salient in textual analysis

In addition to rice, participants listed frequently consuming cassava during pregnancy. Aside from carbohydrates, participants also consumed fruits during pregnancy. Banana, mangoes, oranges, guava, and pineapples were the most frequently consumed fruits.

Compare and contrast diets in Burkina Faso and Madagascar

Overall, across Burkina Faso and Madagascar, participants' typical diets during pregnancy were rich in carbohydrates such as rice. To a lesser extent, participants in both settings consumed fruits such as bananas and meat during pregnancy. In addition, in both settings, participants did not mention consuming prenatal supplements during pregnancy.

Factors that influence how women during make decisions about what they consume in Burkina Faso

Utilizing the food choice process model as the framework, interviews, and free list fieldnotes data indicated that four themes influenced women's nutrition decision-making (Figure 7). Women during pregnancy in Burkina Faso made nutrition decisions firstly based on social factors related to husbands, family and friends, and health professionals. Secondly, women made decisions based on resources such as finances. Thirdly, participants made decisions based on personal factors, including food cravings and food aversions. Lastly, participants also listed ideals such as food prescription and food proscription as factors that influenced women's nutrition decisions during pregnancy. These influencing factors were found to inform and shape people's personal systems, which ultimately led to dietary intake decisions. There were two scenarios based on personal systems, which comprised of minimal and sufficient resources.

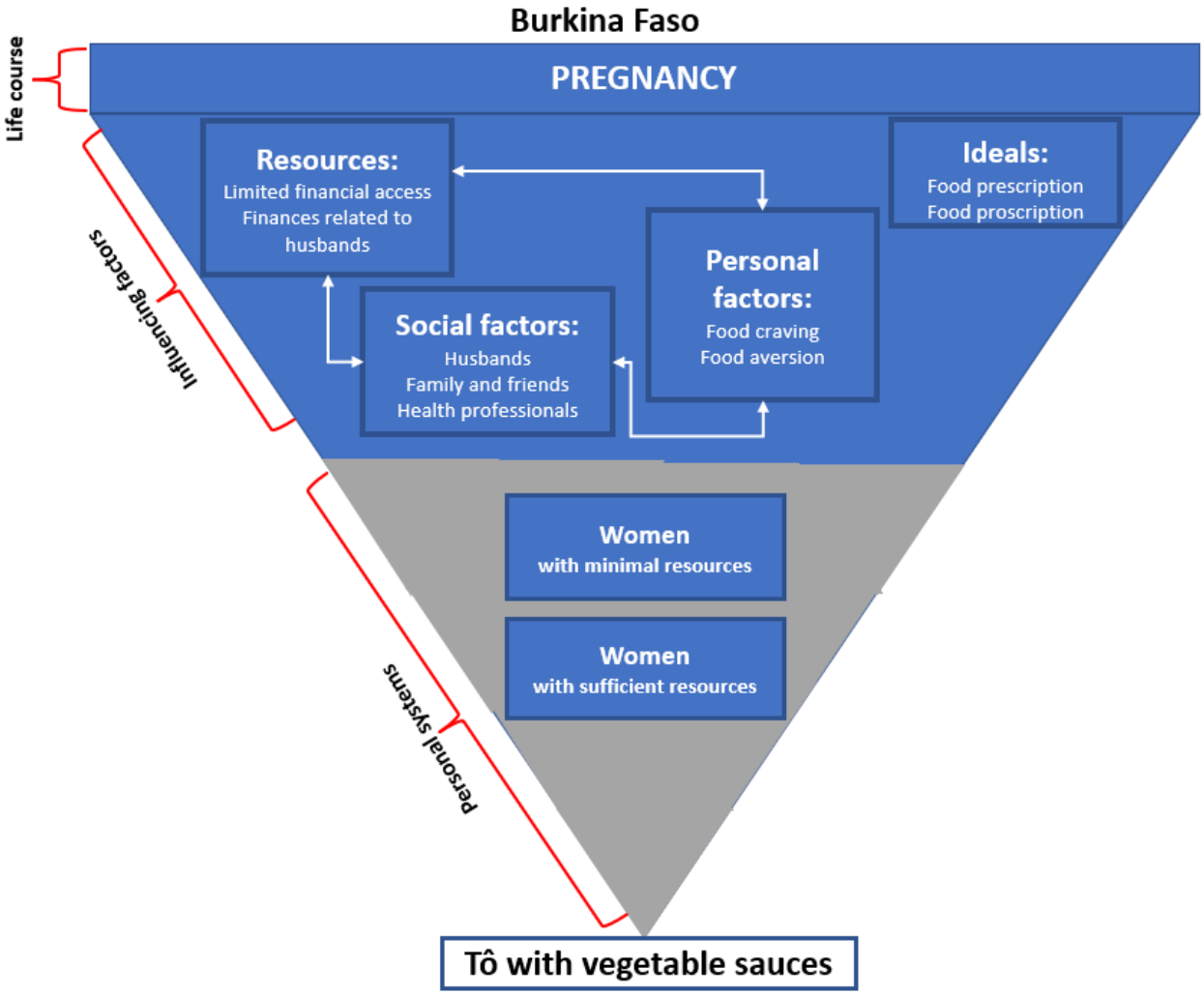

Figure 7. Food choice process model tailored to the Burkina Faso context

Social factors that influence women's nutrition choices during pregnancy

Social factors were a major element of the food choice process model that influenced nutrition choices during pregnancy in Burkina Faso. Three social factors were highlighted as key players in influencing women's nutrition decisions, which included: 1) husbands, 2) family and friends, and 3) health professionals.

Husbands

In Burkina Faso, husbands were identified as a primary social factor influencing women's decisions. In addition, husbands were found to be primarily responsible for household-related finances. Nonetheless, participants mentioned that some men did not uphold their household

financial responsibility for food purchases, except during the holiday. This finding was highlighted by a participant during a focus group interview,

> *"If it is not a holiday, some men do not give the money. But if it is a feast day, he can go and buy meat plus two dishes of rice for cooking. After the holiday period, there is nothing left. Even the money for spices they do not give."*
> -Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

Participants also mentioned limited access to *sachet noir* (prepared foods in black bags purchased outside the home) during pregnancy from their husbands. This forced women to resort back to typical foods. This statement was illustrated by one participant,

> *"Once you're pregnant, there's no more "black bag." The "black bag" disappears [group laughter]. You have to eat the tô."*
> -Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

Other participants further discussed husbands' influence on what foods to eat. Women discussed cooking first for their husbands because they are the "head of the household." To a lesser extent, in Yako, Burkina Faso, participants highlighted eating what their husbands brought home or cooking food that their husbands wanted at home. The quote below illustrates a participant's response to a husband's influence on what to eat,

> *"I will prepare the bean. It is an obligation to do what the husband wants."*
> -Focus group, Yako, Burkina Faso, pregnant or lactating woman

Occasionally, participants also discussed husbands' influence on women's ability to freely go to the health center for prenatal consultations. Participants highlighted either being encouraged or advised by their husbands to attend the clinic. When participants were asked about seeking permission from husbands to attend the clinic, one woman responded with the following,

"You can remind him the day before you have an appointment in case, he has something scheduled. You can tell him that your appointment is tomorrow, for example, or on the morning of the appointment, you can tell him that you are going to your appointment. He will not refuse you; he will wish you a good trip."
-Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

This demonstrates the critical role that husbands play in multiple aspects of the household in Burkina Faso, but family and friends also socially influence women's nutrition choices.

Family and friends

Other social factors that influenced participants' nutrition decisions included: parent-in-law, brother-in-law, women's mother, and friends. For example, participants mentioned that their mothers and brothers-in-law influenced their decisions to attend the prenatal clinic. At the same time, mothers-in-law advised their sons to provide special foods during pregnancy. Additionally, brothers-in-law in Ziniare, Burkina Faso, influenced women's decisions on supplement consumption.

Health professionals

Lastly, in addition to family and friends, health professionals also influenced women's nutrition decisions. For instance, women highlighted being recommended by health professionals to eat diverse foods such as fruits and vegetables because they are vitamin-rich foods. In addition, women were advised to reduce salt and sugar. For example, one participant during focus groups stated the following,

"We were told to reduce the amount of salt, sugar, and honey because they are not good for the fetus."
-Focus group, Burkina Faso, pregnant or lactating woman

This demonstrates the role that these interpersonal relationships play in influencing women's nutrition decisions during pregnancy.

Resources that influence women's nutrition choices during pregnancy.

In addition to social factors influencing women's nutrition decisions, two resources were frequently mentioned during pregnancy, 1) resources related to social factors and 2) limited financial access.

Resources related to social factors

Participants frequently connected social factors and resources, specifically, husbands' influence on finances. This study found that husbands are the most frequently cited individuals responsible for the financial resources in the household compared to other groups (Figure 8).

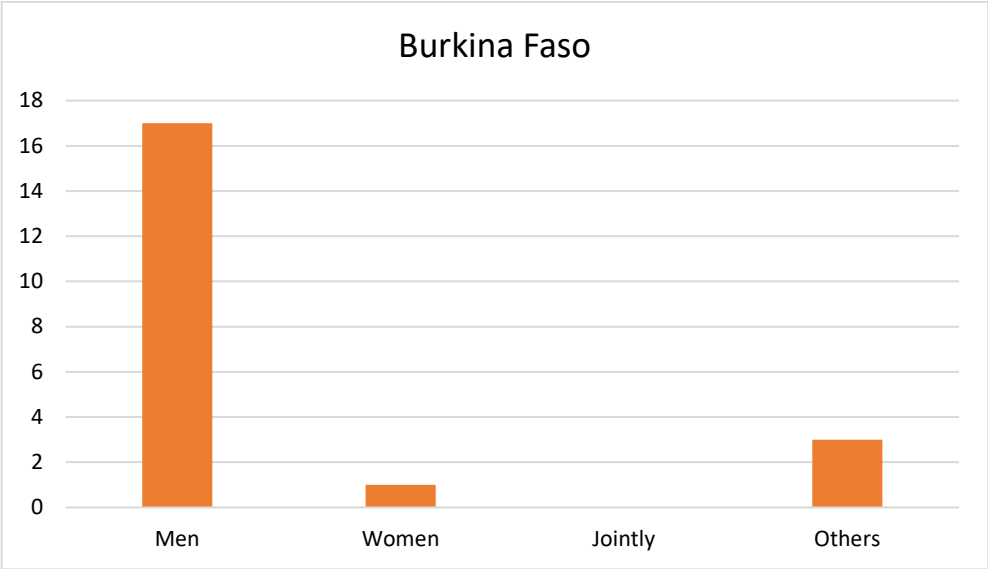

Figure 8. Financial responsibility per group based on frequency of mention in Burkina Faso

Men are responsible for the finances needed for food access and prenatal supplements. For instance, one participant mentioned during an interview,

> *"When you want something, you inform the husband and if he has it, he gives you the money to go and get it."*
> -Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

Furthermore, in the event where women needed money to purchase food, participants asked their husbands. Women explicitly mentioned that if their husbands did not provide money, they gave up their request, utilized the foods available at home, and waited until the next day to make another

request. Nonetheless, participants also mentioned that if they had money available, it could be used to help supplement food purchases.

In other cases, participants mentioned circumstances where husbands dictated food purchases. For example, women indicated that men provided money for food purchases when planning to eat at home or have guests. In addition, participants highlighted that the taste of food at home depended on the money the husband provided, as more money meant that they could buy spices or other flavorful ingredients. Moreover, in Ziniare, Burkina Faso, men were expected to make food decisions when they provided finances. For example, a participant during a focus group interview explained the following regarding men's nutrition decisions,

> *"It is when the man gives you the money that he can tell you to cook what he wants."*
> -Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

Men and women were found to be responsible for finances. However, women had less financial responsibility. One participant cited during an interview,

> *"The wife takes care of the spices. But there are also good husbands who give their wives the money for spices. If this is not the case, the wife buys her own spices to give to her children first."*
> -Focus group, Yako, Burkina Faso, pregnant or lactating woman

Lastly, to a lesser extent, participants identified other individuals such as their mothers and older children who were responsible for foods and supplements-related finances. Ultimately, lack of finances was also an influencing factor on women's nutrition decision-making.

Limited financial access

A major resource element that influenced women's nutrition decisions was limited financial access. In Burkina Faso, women discussed the lack of food affordability and financial support. For example, participants explained that they consumed *tô* either derived from millet or corn, depending on the availability of finances. While *tô* is generally derived from millet,

participants mentioned that corn based *tô* was consumed when there was money. To express the limited financial access, participant during the interview highlighted the following,

> *"As you are in charge of your expenses and given your means, if you earn 50f you buy either the okra or the baobab leaves for cooking. You don't have enough money to buy the spices to keep them for the preparation."*
> -Focus group, Yako, Burkina Faso, pregnant or lactating woman

Overall, participants strongly cited resources, specifically, finances as a major influencing factor of nutrition decisions during pregnancy. Women equally highlighted the connection between social factors and resources as it related to decision-making.

Personal factors that influence women's nutrition choices during pregnancy.

Personal factors were found to be an element of the food choice model that influenced women's nutrition choices during pregnancy. To some extent, the element of personal factors was noted to be connected to resources (finances) and social factors (husbands). For example, some participants cited typically cooking food that their husbands preferred. However, in cases where they were craving other foods during pregnancy, with additional money, they opted to cook two dishes, one for themselves and one for the husband. This was described by a participant in Yako,

> *"You will do what the husband wants... but as it is the pregnancy that demands you, if you can afford it, you will do both; if not, you will bear it."*
> -Focus group, Yako, Burkina Faso, pregnant or lactating woman

On the contrary, some participants mentioned the need to frequently consume foods, otherwise they might feel dizzy and hungry during pregnancy. In addition to the interconnectedness discussed above, two personal factors were found to influence women's nutrition decision-making 1) food cravings and 2) food aversion.

Food craving

Food craving was one of the most frequently mentioned types of personal factors among women. Participants described craving foods such as chicken and fruits. Participants also cited that the smell of certain foods heightened their cravings. This statement was mentioned by one participant,

> *"Yes! Now when it comes to pregnancy, it's what she'll want you to eat. It is the pregnancy that will dictate what she would want you to eat."*
> - Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

Furthermore, women mentioned that food cravings often led to them consuming foods they had never eaten before. One woman during a focus group illustrated the following statement by stating,

> *"Pregnancy is the reason for cravings. It can lead you to eat food that you are not used to eating. Even dirt if you have to, you will eat it. All this is a mystery."*
> -Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

This quote shows the critical role that food cravings play in nutrition decision-making among women during pregnancy.

Food aversion

Participants cited food aversion as a type of personal factor that influenced nutrition choices. For example, women mentioned being unable to stand the smell of rice, not craving snacks due to nauseating feelings, feeling nauseous when thinking of cooking, and vomiting after eating riz gras (rice-based dish). A participant responded the following when asked about why they did not eat certain foods,

> *"I: But why don't you eat [riz gras]?*
> *A: Because when I eat it, I throw up."*
> -Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

Inability to eat was one sub-theme of food aversion that emerged during the interviews. For example, participants discussed their inability to eat rice due to its odor. Below is a quote that illustrated women's inability to eat,

"I: What has changed?
R: I can't eat the rice anymore.
I: Why?
R: I can't stand the smell of rice anymore!"
-Semi-structured interview, Yako, Burkina Faso, pregnant woman

While participants were unable to tolerate certain foods due to its odor, they were able to purchase other foods of their choice with the support of their husband's finances. To a lesser extent, participants listed vanished cravings during pregnancy. For example, odor of certain foods was identified as the sensory property which reduced cravings, as mentioned by one pregnant woman,

"I don't like peanut paste. There are foods that I crave but as soon as I get them, their smell invades me at the same time, and I don't want them anymore."
-Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

While rice was a typical food consumed during pregnancy, participants could not tolerate the smell. Thus, it ultimately impacted their nutrition decision on whether to consume it or not. Overall, this demonstrates participants perceived food cravings and aversions as salient sub-themes and influencing factors of nutrition decision-making during pregnancy.

Ideals that influence women's nutrition choices during pregnancy.

Lastly, participants listed ideals as a factor that influenced women's nutrition choices during pregnancy. Ideals related factors that influenced nutrition decision-making included 1) food prescription and 2) food proscription (taboos).

Food prescription

Participants categorized several foods as food prescription, including peanuts, clay, fruits, fish, and meat (Table 4). Women provided cultural reasons explaining why the prescribed food

was considered good. These reasons included positive birth and health outcomes for the mother and fetus.

Table 4. Food prescriptions during pregnancy in Burkina Faso

Name and description of food	Cultural explanation for why it should be consumed during pregnancy
Peanut	It is a substitute of meat or fat
Clay	Consumed to avoid nausea
Mixed leaves sauce with sour taste, available year round	Digestible, helps to fight against constipation and contains a lot of vitamins because it is made of several leaves
Meat and fish	Contains a lot of vitamins and is good for mother and child health
Fruits (orange/banana/mango)	Contain vitamins and are good for mother and child health

Participants equally discussed foods related to food proscription (taboos) and provided explanations for them.

Food proscription (taboos)

Participants responses on forbidden foods included eggs, pork, honey, milk, and pepper (Table 5). Some of the cultural explanations for these food taboos included negative birth outcomes and religious reasons.

Table 5. Food proscriptions (taboos) during pregnancy in Burkina Faso

Name and description of food	Cultural explanation for why it should be avoided during pregnancy
Milk	If a woman consumes yaourt her baby will grow too much, and she will have problem during delivery
Sheatfish	If a woman consumes it, her baby will born with a head that looks like the sheatfish's head
Pepper	If a woman consumes pepper her baby will born with small lesions on the skin, and s/he suffer from stomachache
Eggs	I don't know why but we were told that a pregnant woman should not eat eggs
Pork or donkey meat	It is forbidden by the religion
Rat meat	We were told that if a woman consumes rat meat her baby will become a thief
Honey	I don't know exactly the reason pregnant women should not consume it, but it seems like it can cause abortion or miscarriage
Melon/sugar apple	Both increase the amniotic fluid and cause complications during pregnancy

These influencing factors listed above have been found to inform and shape people's personal systems which are developed through value negotiations and strategies. Based on the data, personal systems were based on monetary consideration, managing relationships, and health and nutrition, which affected women's nutrition decision-making. Specifically, factors such as minimal resources and sufficient resources were found to inform and shape personal systems.

Women with minimal resources

Women with minimal resources had limited access to navigating the value negotiation process to make nutrition decisions. For example, participants described fish as a food prescription because it provided vitamins to pregnant women and baby. Despite the positive perceptions of fish, finances were listed as a barrier to fish consumption. This was illustrated during a focus group interview,

> *"…if you never have the opportunity to eat fish and you feel like it during your pregnancy, you will have to be patient. If you want a simple [cheaper] meal, it is better. For some people these [fish] are expensive meals."*
> – Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

This indicates that women were financially limited on what kinds of foods they can consume during pregnancy. In addition to limited finances to women's nutrition choices, monetary consideration influenced relationship management. Participants cited instances where men did not financially provide for food, and often ate out. Due to this, women made decisions alone regarding what to eat. This statement was reflected in the following quote below,

"Because he didn't give anything. If you don't give anything you can't force the woman to prepare what she doesn't want."
– Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

This demonstrates that with minimal resources, often due to men's lack of financial responsibility, women made decisions related to what to eat.

Other participants described making decisions alone about what to cook. However, with limited resources, in situations where they had to choose between cooking what they or their husbands wanted, they opted to cook what their husbands requested. One participant explained the importance in cooking what their husbands wanted to eat by stating,

"I also ask him what he wants to eat before I cook. If I cook and he refuses to eat, I will not be happy."
-Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

This quote shows that even with limited resources, women aimed to manage their marital relationships in order to maintain harmony. Managing relationships was also an important element of consideration during situations when women had to attend the health center. For example, women expressed the importance of informing their husbands before their departure to the health center, partly to avoid conflict and ensure that their husbands will pay for any supplement prescribed by health professionals.

Women with sufficient resources

Other participants discussed having a sufficient number of resources which helped facilitate value negotiation to make food decisions. For example, one woman mentioned that she owned her own business, her husband worked, and her family grew various food staples such as cereals. Thus, providing them with adequate household resources. In circumstances where women had to choose between cooking their husbands' preferred meal or their own, they often opted to cook both with sufficient resources. One woman during a focus group in Yako mentioned, "if you have [financial] means, you do [cook] both." Another participant emphasized cooking first for her husband and then cooking her meal because he is the head of the household. This statement was illustrated in the following quote,

> *"I cook for my husband first, since he is the head of the household before taking care of my dish."*
> - Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

The quote above can suggest that with sufficient resources, women can easily manage their marital relationships by cooking both meals.

In addition, other participants described deciding what to consume as it related to finances and pregnancy. Participants received money from their husbands, which enabled them to purchase the foods they wanted. This was illustrated by the quote below,

> *"If I want to vary the dishes, I can go to my husband and tell him that I would like to prepare such and such a meal and would like him to give me the money to purchase the necessary cooking items."*
> - Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

Furthermore, women mentioned that the pregnancy facilitated their ability to make nutrition choices with the support of their husbands. For example, husbands allowed women to cook what they wanted because of their pregnancy. This was explained by an individual during interview,

"He [husband] accepts it [food the wife chooses] because he knows that it is not your habit to tell him that you would like to cook such and such a dish instead of what he wants. And if you do, it's because you really want to eat that food and he knows that it's not necessarily your fault because it could be due to the pregnancy."
-Semi-structure interview, Yako, Burkina Faso, pregnant woman

In other words, husbands in this case were more understanding and opted to eat what their wives wanted during pregnancy.

Factors that influence how women during pregnancy make decisions about what they consume in Madagascar

Based on interviews and free list fieldnotes data, a total of five themes were found to influence women's nutrition decision-making in Madagascar (Figure 9). Women during pregnancy in Madagascar made nutrition decisions firstly based on food context related to limited food availability and seasonality. Secondly, participants made nutrition decision during pregnancy based on social factors, including husbands, family, friends, and health professionals. Thirdly, women during pregnancy made nutrition decisions based on resources such as finances. Fourthly, nutrition decision was also influenced by personal factors such as food craving, food aversion, food dislike, lack of appetite, food liking, and food preference. Lastly, decisions were made based on ideals such as food prescription. These influencing factors were shown to inform and shape people's personal systems, which were developed through value negotiations and strategies, and ultimately led to nutrition decisions. Only one scenario based on personal systems was noted, which was related to minimal resources.

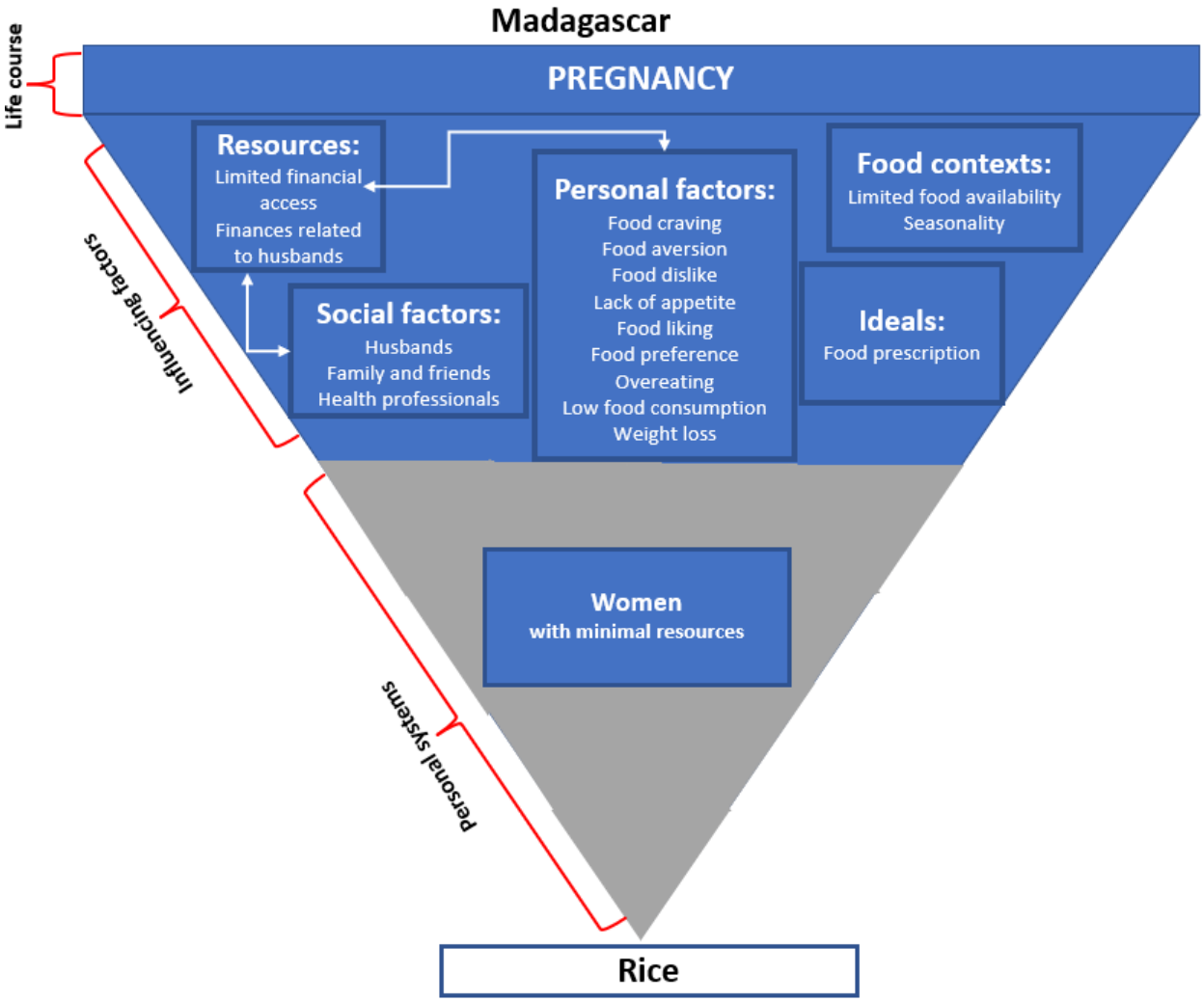

Figure 9. Food choice process model tailored to the Madagascar context

Food contexts that influence women's nutrition choices during pregnancy

According to the data, participants listed food context-related factors less frequently. Women mentioned seasonality and limited food availability as the main components of the food context that influenced nutrition choices during pregnancy. For instance, one participant noted the following related to food context,

> *"These are all the foods that we ate, because we are in the countryside and there is not much food here."*
> -Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

This statement indicates that women did not have access to an abundance of foods in the countryside, which may influence women's nutrition decision-making.

Social factors that influence women's nutrition choices during pregnancy

Social factors were noted to be a major element of the food choice process model that influenced nutrition choices during pregnancy in Madagascar. Three social factors were highlighted as key elements when it came to influencing women's nutrition decisions; these included 1) husbands, 2) family and friends, and 3) health professionals.

Husbands

Husbands were identified as the primary social factor influencing women's nutrition decisions. Husbands were also found to be primarily responsible for household-related finances. The connection between husbands and finances is illustrated in the following quote from an interview,

> *"...if there were food that I want to eat, I ask my husband, and he gives me money to buy it."*
> -Semi-structured interview, Itasy, Madagascar, pregnant woman

Moreover, in Itasy, women discussed being influenced by what their husbands wanted to eat. Occasionally, participants also discussed husbands' influence on women's ability to freely go to the health center for prenatal consultation. When participants were asked about seeking permission from husbands to attend the clinic, one woman responded with the following,

> *"...when he is not here, we have decided to go. But if he is there, we have to ask for him."*
> -Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

This demonstrates the critical role that husbands play in multiple aspects of the household in Madagascar.

Family and friends

Other social factors that influenced participants' nutrition decisions included: parents of participants, brother-in-law, and friends. Specifically, in Itasy, brother-in-law and parents of participants influenced women's decision on supplement consumption. Whereas in Vatovavy Fitovinany, friends influenced participants' ability to attend prenatal clinic.

Health professionals

Health professionals were an additional social factor that appeared during interviews. For instance, health professionals were mentioned by participants to influence their nutrition choices. Examples of health professionals identified included sage femme (midwife), community health agents, and doctors. This was illustrated by one participant during an interview,

> *"It's me, because the midwife and the community health worker advise me to take this pill."*
> -Semi-structured interview, Itasy, Madagascar, pregnant woman

Participants indicated being advised to consume prenatal supplements during pregnancy by the above-mentioned health professionals.

<u>Resources that influence women's nutrition choices during pregnancy</u>

In addition to social factors, two resources were found to be the most frequently mentioned factors that influenced women's nutrition choices during pregnancy, 1) resources related to social factors and 2) limited financial access.

Resources related to social factors

Participants frequently linked social factors and resources, specifically husbands' influence on finances. In other words, husbands were the most frequently cited individuals responsible for the financial resources in the household compared to other groups (Figure 10).

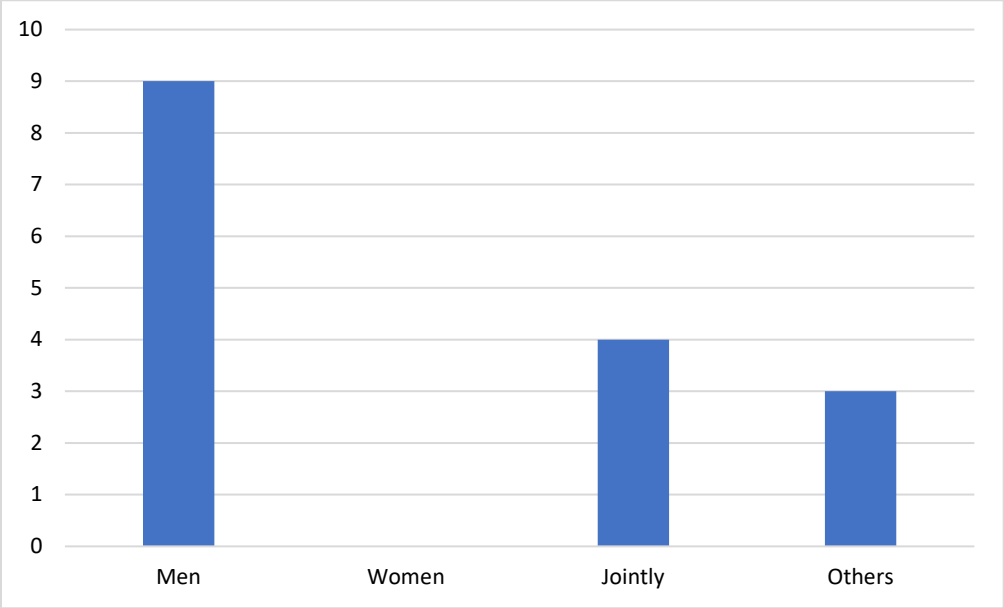

Figure 10. Financial responsibility per group based on frequency of mention in Madagascar

Men were responsible for finances needed for food access and pre-natal supplements. For instance, one participant mentioned during an interview,

> *"I: OK! and for your family's sources of income, can you explain to me who gets the money so that you can buy food in your home? A: It is my husband who takes care of our financial needs."*
> -Semi-structure interview, Itasy, Madagascar, pregnant woman

Similarly, to Burkina Faso, women in Madagascar equally highlighted the connection between husbands as the primary individual responsible for finances in the household.

Limited financial access

Another major resource element that influenced women's nutrition decisions was limited financial access. Participants mentioned that the lack of financial access often limited the kind of foods they could purchase and consume. This statement is illustrated in the following quote below,

"Yes, even if I want to eat chicken for example, if I can't afford it, I can't eat it."
-Focus group, Itasy, Madagascar, pregnant or lactating woman

Limited resources often also caused women to lower their consumption of rice due to its high cost. As such, cassava was found to be an alternative food item. This statement was illustrated by one participant,

"The pregnant woman eats cassava every day at noon and after eating it she takes some rice. Fresh cassava or dried cassava from the family's agriculture. Pregnant women eat it because they don't have much money to buy rice."
-Free list field note, Itasy, Madagascar, pregnant women

This shows the implications that limited access to finances plays in regard to nutrition decision-making during pregnancy.

Personal factors that influence women's nutrition choices during pregnancy

Participants frequently reported personal factors to influence nutrition choices during pregnancy. Furthermore, there was a connection between personal factors and finances. In addition to the theme connections discussed above, nine personal factors were found to influence women's nutrition decision-making during pregnancy, these included 1) food cravings, 2) food aversion, 3) food dislike, 4) food liking, 5) lack of appetite, 6) food preference, 7) overeating, 9) low food consumption, and 9) weight loss.

Food cravings

Food craving was one of the most frequently mentioned types of personal factor among women. Participants also cited that the smell of certain foods heightened their cravings. Participants' food cravings comprised of sardines, acidic foods, savory foods, pork, zebu meat,

fruits, and spaghetti. The craving of certain foods was illustrated by a participant in the following quote,

"…when I was pregnant, I didn't like cassava and rice, but I crave acidic foods all the time."
-Focus group, Itasy, Madagascar, pregnant or lactating woman

In addition, women cited food craving as a major sub-theme of the personal factor system that influenced their nutrition choices during pregnancy. However, women's ability to obtain those cravings were often dependent on resources such as finances. This was illustrated by one participant during an interview,

"When I crave something to eat, if I have the money I go shopping and come back to cook. But when I don't have the money, I cook what is available."
-Semi-structure interview, Itasy, Madagascar, pregnant woman

This demonstrated that satisfying a food craving was often dependent on finances, which determined what women could or could not consume during pregnancy.

Food aversion

In addition to food craving, participants cited food aversion as a type of personal factor that influenced nutrition choices. For example, women mentioned being unable to eat certain foods during pregnancy, that they previously consumed prior to pregnancy. Participants also discussed dealing with other contributing factors of food aversion during pregnancy such as vomiting. A participant mentioned the following information related to food aversion,

"I: Really? What could happen if you insist on eating them [foods consumed prior to pregnancy]?
R: Vomiting!"
-Semi-structured interview, Vatovavy Fitovinany, Madagascar pregnant woman

This indicates that food aversion is a factor that influences women's nutrition decision-making during pregnancy.

Food dislike

Food dislike was a sub-theme that emerged during interviews. In Itasy, participants listed various foods that they disliked. For example, during pregnancy, women mentioned disliking cassava, rice, tea, pistachio, fish, and the smell of beans. Participants also mentioned disliking onions, beans, rice, salty foods, and coffee. One participant during an interview stated,

> *"I hate a lot of things when I'm pregnant, I hate the things I enjoyed before."*
> -Semi-structured interview, Vatovavy Fitovinany, Madagascar, pregnant woman

Despite the frequent consumption of rice during pregnancy, some participants also mentioned a dislike for rice during pregnancy due to its negative side effects. This was stated by one participant,

> *"Yes, there is a change, when I was not pregnant, I ate a bowl of rice, but now that I am pregnant as soon as I eat more than a tablespoon and a half of rice, I feel uncomfortable, and it is as if I were suffocating."*
> -Semi structured interview, Itasy, Madagascar, pregnant woman

This demonstrated that pregnancy changed multiple dietary habits of participants. Therefore, influencing nutrition decision-making.

Food liking

Participants also highlighted foods that they liked during pregnancy. For example, in Itasy, participants listed liking fruits such as banana, mango, papaya, acidic foods, peppers, and beans. In Vatovavy Fitovinany, participants expressed liking salty foods, orange, guava, banana, papaya, and white sand (dirt). Overall, fruits were found to be the most liked food during pregnancy, as indicated by a participant below,

> *"Before I didn't like banana, when I got pregnant, I liked it."*
> -Focus groups, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

Thus, this showed that while women developed a dislike for certain foods during pregnancy, they also gained liking for other food items.

Lack of appetite

Participants listed lack of appetite as a sub-theme of personal factors that emerged during the interview. Participants discussed dealing with lack of appetite at the beginning of pregnancy, as described by one participant below,

> *"For food, at the beginning of my pregnancy until the 3rd month, I have no appetite even for rice, but after the 3rd month, I feel better."*
> -Focus group, Itasy, Madagascar, pregnant or lactating woman

This demonstrated that the lack of appetite influenced women's nutrition decision-making.

Food preference

Participants also mentioned food preference as an emergent sub-theme that influenced women's nutrition decision-making during pregnancy. For example, in Itasy, women mentioned preferring rice and fish, whereas in Vatovavy Fitovinany, participants listed preferring acidic foods instead of rice. To a lesser extent, various other sub-themes emerged during pregnancy including overeating, low food consumption, and weight loss.

<u>Ideals that influence women's nutrition choices during pregnancy</u>

Lastly, participants listed ideals as a factor that influenced women's nutrition choices during pregnancy. Ideals related factors that influenced nutrition decision-making included 1) food prescription and 2) food proscription (taboos).

Food prescription

Similarly, to Burkina Faso, food prescriptions were equally highlighted in Madagascar. Participants mentioned foods including banana, fish, and carrots as foods that should be consumed

during pregnancy (Table 6). Women highlighted the reasons why the foods were considered food prescriptions in the table below.

Table 6. Food prescriptions during pregnancy in Madagascar

Name and description of food	**Cultural explanation for why it should be consumed during pregnancy**
Banana	A banana a day brings vitamins and health if consumed in moderation
Fish	Fresh fish bought at the market. This food provides vitamins for the pregnant woman and for the fetus.
Carrot	Eaten as raw or cooked, it is a good food for pregnant women. They eat it because it is rich in vitamin A which is good for the eyes. This food gives the fetus vitamins and nutrients

Participants equally discussed foods related to food proscription (taboos) and provided explanations for them.

These influencing factors listed above have been found to inform and shape people's personal systems which are developed through value negotiations and strategies. Specifically, minimal resources were found as a factor that informed and shaped women's personal system.

Women with minimal resources

In Madagascar, women with minimal resources, explained how limited resources factored into nutrition decision-making. For example, participants discussed limited resources affected daily meal frequency, as illustrated by one participant in Itasy,

"But there were times when we had no money, we only ate in the morning and in the evening."
-Semi-structured interview, Itasy, Madagascar, pregnant woman

In addition to minimal resources factoring into meal frequency, participants also discussed other instances where limited finances affected what pregnant women could eat or purchase. This statement was demonstrated in the following quote,

> *"Meat is too expensive, the 500g is worth 5000ar, so it is very difficult to buy with our money. I wanted to eat the liver of the beef."*
> -Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

This demonstrates how limited finances factors into women's decision-making during pregnancy. Participants also discussed how financial constraints limited their access to healthy nutrition intake needed during pregnancy. This statement was highlighted during an interview in Itasy,

> *"We don't have money to buy [healthy foods] and follow these diets, we just buy rice with side dishes that are cheap and that's it."*
> -Semi-structured interview, Itasy, Madagascar, pregnant woman

In addition, participants discussed how the financial constraint did not allow them to afford purchasing supplements. In turn, that influenced their strategies in nutrition decisions, as one participant indicated,

> *"…because we don't have the means [finances] to buy vitamin tablets. People advise me to drink soya milk to have vitamin and strength."*
> -Semi-structured interview, Itasy, Madagascar, pregnant woman

This demonstrates that participants are aware of healthy foods to consume during pregnancy, however, limited finances often make it difficult to follow such diet, thus impacting their decision-making.

Compare and contrast factors that influence how women make decisions about what they consume during pregnancy in Burkina Faso and Madagascar

Overall, in Burkina Faso and Madagascar, multiple factors influenced women's nutrition decision-making during pregnancy. Participants in both countries mentioned that resources, social factors, personal factors, and ideals were factors that influenced nutrition decision-making. Furthermore, Madagascar was the only setting where participants listed food context as an additional factor that influenced nutrition decisions. Moreover, in both settings, there was an interconnectedness between two sets of factors which comprised of 1) resources and social factors and 2) resources and personal factors. In Burkina Faso only, an additional connection was made across personal factors, resources, and social factors. These interconnected factors were found to influence women's nutrition decision-making during pregnancy.

In addition to establishing factors that influence women's nutrition decision, these factors were able to inform and shape people's personal systems. This generated a total of two archetypes which explained how women made nutrition decisions. Across both countries, one archetype related to personal systems which explained how women navigated nutrition decisions with minimal resources. Meanwhile in Burkina Faso only, there was an additional archetype noted which explained how women navigated nutrition decision-making with sufficient resources.

Extent to which women have nutrition decision-making autonomy over what they consume during pregnancy in Burkina Faso

In Burkina Faso, it was found that men were the prime decision makers when it related to how to spend money, what to eat, and travel to health center. While women were the prime decision makers in decisions related to supplement consumption. This was observed in two categories of inquiry, as it related to decisions on how to spend money and decisions on what to eat. In addition to the two categories of inquiry related to food decisions listed above, participants were also asked two ancillary nutrition decisions questions, as it related to health seeking behavior during pregnancy. The two categories of inquiries were: 1) decision on supplement consumption and 2) decision to travel to health center.

Decisions on how to spend money

In Burkina Faso, participants mentioned that men were the primary individuals who made decisions on how money should be spent (Table 7).

Table 7. Frequency of mention on money and food decision-making in Burkina Faso

Decision on…	Decision maker	Frequency of mention	Quotes
How to spend money	Women	3	"When the husband gives me the money to go pay, I decide on how I will spend the money." -Semi structure interview, Yako, pregnant woman
	Men	5	"I: Who decides how the money should be spent? R: It's the husband!" -Semi structured interview, Yako, pregnant woman
	Others	1	"I: But who makes the decisions on how to spend the money? A: The first wife says how to spend it." -Semi structured interview, Ziniare, pregnant woman
	Joint	0	
What to eat	Women	5	"When I want to prepare the tô today, I do it. Tomorrow I can prepare beans." -Semi structured interview, Yako, pregnant woman
	Men	16	"I: OK! but who makes the decision about your daily menu? A: The husband makes the decisions about what to eat." -Semi structured interview, Ziniare, pregnant woman
	Others	1	I: "Who decides what you are going to eat every day while you are pregnant? A: My mother!" -Semi structured interview, Ziniare, pregnant woman
	Joint	0	

For example, men decided on whether to provide finances for food purchases. One participant during an interview cited the following related to financial decisions by men,

"...there are days my husband when he knows the prices, he gives [money] but when he does not know, he asks, I tell him then he gives me the money to go pay."

-Semi-structured interview, Yako, Burkina Faso, pregnant woman

In addition to men being the prime decision makers on how to spend money, women were the secondary decision makers. To a lesser extent, a participant listed other individuals who made financial decisions, specifically the first wife, as stated during the interview,

"I: But who makes the decisions on how to spend the money?
R: The first wife decides how to spend it."
-Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

This shows the various individuals who take part in decision-making on how to spend money in Burkina Faso.

Decisions on what to eat

It was found that the most frequently mentioned group who made decisions related to what to eat were men. Participants emphasized that men chose what to eat in the household. One woman during an individual interview, explicitly stated that "it is what he wants that we do." Other participants also highlighted cooking what they wanted, in addition to the meals their partners requested. In circumstances were women wanted to choose what to eat, they still opted to choose what their husbands wanted to avoid conflict, as one participant said during the interview,

"I will cook cowpea [husband's food choice] to maintain harmony in the family."
-Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

In Yako, it was also frequently mentioned that women made decisions related to what to eat, but to a lesser extent compared to men. Meanwhile in Ziniare, other individuals such as the mother of

the participant was found to make decisions related to what to eat. There was no mention related to a joint decision being made in this instance.

The additional two ancillary nutrition decisions categories of inquiries, as it related to health seeking behavior during pregnancy included 1) decision on supplement consumption and 2) decision to travel to health center (Table 8).

Table 8. Frequency of mention on supplement and travel decision-making in Burkina Faso

Decision on…	Decision maker	Frequency of mention	Quotes
Supplement consumption	Women	41	"Since I know the importance of iron, nobody tells me, I take it myself." -Semi structured interview, Yako, pregnant woman
	Men	4	"I: But who decides what foods to eat and what supplements to take each day? R: It's often the husband who decides!" -Semi structured interview, Yako, pregnant woman
	Others	5	"I: But who decides about taking the products [supplements]? R: It is the health workers." -Semi structured interview, Yako, pregnant woman
	Joint	0	
Travel to health center	Women	16	"It's me who decides. As we are given appointments and we put the date on the notebook. If I take the notebook and see that the date has arrived, I tell him [husband] that I am going to the CSPS for a consultation." -Semi structured interview, Yako, pregnant woman
	Men	29	"I: If you have to go for a health consultation, who gives you permission? R: It's the head of the household. I called him last night to ask for permission to go for a consultation today. He agreed." -Semi structured interview, Ziniare, pregnant woman
	Others	2	I: But since you are pregnant, when you want to come to the health center to get the supplements, who makes the decision? R: My mother! - Semi structured interview, Ziniare, pregnant woman
	Joint	0	

Decisions on supplement consumption

In Burkina Faso, it was found that women were the primary decision makers related to supplement consumption. For example, some women, in both settings, attributed the decision to consume supplements to its health benefits, as one pregnant woman described,

"If you want to be healthy, it is up to you to take your products without looking for someone to tell you."
-Semi-structured interview, Ziniare, Burkina Faso, pregnant woman

While women were the primary decision makers, other individuals, specifically health agents were the second most frequently mentioned group who made decisions for women related to supplements. Thirdly, participants mentioned that men were the third group of individuals who made decisions related to supplement consumption. Lastly, participants during interviews did not highlight couples jointly making decision related to supplement consumption.

Decisions to travel to health center

In Burkina Faso, it was found that men, specifically husbands, were the primary decision makers in matters related to women's ability to seek permission to travel to a health center. In Yako, some women cited that with the man's permission, they received money from their husbands to pay for the health visit fee. Some participants also mentioned that seeking permission from their husband also helped avoid conflict. Women emphasized that they will not be able to attend the health center without their husbands' permission, as noted by one participant,

"You need to get permission from your husband to go! Often you can forget the date of the appointment and he will call you back. If you don't get permission from him, you can't decide to go on your own, because if you go without his permission, your husband might get angry!"
-Focus group, Ziniare, Burkina Faso, pregnant or lactating woman

Aside from men primarily making this type of decision, women were the second most frequently mentioned group who made decisions alone to attend the health center. In addition, other

individuals such as health agents and the mother of participants also decided for the participant to seek a health visit.

Extent to which women have nutrition decision-making autonomy over what they consume during pregnancy in Madagascar

In Madagascar, it was found that men and women equally made decisions on how to spend money, and travel to health center. Meanwhile, women alone primarily made decisions related to what to eat and supplement consumption. This was observed in two categories of inquiry as it related to decisions on how to spend money and decisions on what to eat. In addition to the two categories of inquiry related to food decisions, participants were also asked two ancillary nutrition decisions questions, as it related to health seeking behavior during pregnancy. The two categories of inquiries were decision on supplement consumption and decision to travel to health center.

Decisions on how to spend money

Participants equally mentioned that both men and women made decisions on how to spend money (Table 9).

Table 9. Frequency of mention on money and food decision-making in Madagascar

Decision on…	Decision makers	Frequency of mention	Quotes
How to spend money	Women	5	"When I earn money I have to buy it, that is to say that I look for the money and I buy all that I want and then I also prepare it." -Focus group Vatovavy Fitovinany, pregnant or lactating woman
	Men	5	"I: At that point, who decides how much money to spend on food? R: The husband!" -Focus group, Itasy, pregnant or lactating woman
	Others	0	
	Joint	4	"I:OK! and how do you manage your spending in your household? who makes the decision? R: We make the decision together sometimes." -Semi structured interview, Itasy, pregnant woman
What to eat	Women	23	"I take as an example the cassava, when I eat it at night, I decide not to eat it tomorrow." -Focus group, Vatovavy Fitovinany, pregnant or lactating woman
	Men	7	"But it is always our husband who decides what we can eat! Because it is him who gives us money." -Focus group, Itasy, pregnant or lactating woman
	Others	0	
	Joint	3	"I: And when it comes to preparing your meals, who decides what you should eat? R: We talk a little and then we make the decision together." -Semi structured interview, Itasy, pregnant woman

Women cited that having access to finances allowed them to decide how to spend money for food items, as one participant mentioned below,

"For me I have to look for it, no matter that I found it, when I earn money, I have to buy it, that is to say that I look for the money and I buy all that I want and then I also prepare it."
-Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

In addition to women making decisions on how to spend money, participants cited that men also made decisions. Men will provide money and decide how it should be managed. During a focus group interview, one participant highlighted the following related to the previous statement,

"...when my husband comes to work, he gives me the money, you go shopping at the market today."
-Focus group, Itasy, Madagascar, pregnant or lactating woman

Lastly, there was mention of couples jointly deciding on how to spend money, and no mention of other individuals who partook in decisions on how to spend money.

Decision related to what to eat

In contrast to Burkina Faso, women in Madagascar were the primary decision makers when deciding what to eat (Table 9). Women indicated that their pregnancy was one of the reasons that influenced their ability to make decisions related to what to eat. The example below indicates such instance when a pregnant woman was asked who makes decision about what to eat,

"It's me, because my husband works all the time, and I buy everything I want to eat, he understands me because I'm pregnant, there is no problem in our home about this."
-Semi-structured interview, Itasy, Madagascar, pregnant woman

Participants also cited that men decided what to eat in both districts. This was illustrated in an interview by one participant,

"It is my husband who makes the decision about the foods we eat every day."
-Semi-structured interview, Itasy, Madagascar, pregnant woman

In addition, in Itasy only, there was mention of couples jointly deciding what to eat. Lastly, there was no mention of other individuals' deciding what to eat.

The additional two ancillary nutrition decisions categories of inquiries were: 1) decision on supplement consumption and 2) decision to travel to health center (Table 10).

Table 10. Frequency of mention on supplement and travel decision-making in Madagascar

Decision on…	Decision maker	Frequency of mention	Quotes
Supplement consumption	Women	31	I: And at home when you go to take the iron-folic acid pill, who decides? R: It's me because I'm carrying the baby, so I never forget to take it. -Semi structured interview, Itasy, pregnant woman
	Men	6	"I ask his permission; I ask my husband's permission!" -Focus group, Vatovavy Fitovinany, pregnant or lactating woman
	Others	4	"It is the doctor who tells me to take iron-folic acid tablets." -Focus group, Itasy, pregnant or lactating woman
	Joint	2	"We decide together! If we have money, we buy it!" -Semi structured interview, Itasy, pregnant woman
Travel to health center	Women	15	"I am the one who decides because I am responsible for my body, I could go immediately. Besides, the doctor is close by." -Semi structured interview, Itasy, pregnant woman
	Men	15	"I ask him that I have to go to do CPN, and if we have money, he tells me to take a car, and if we don't have money, I go on foot." -Semi structured interview, Vatovavy Fitovinany, pregnant woman
	Others	6	"I: Before leaving for the hospital in Androrangavola or Ifanadina, do you ask for someone's permission or do you leave without asking for permission? A: Yes, I ask permission! I: Who do you ask permission from? A: My parents!" -Semi structured interview, Vatovavy Fitovinany, pregnant woman
	Joint	2	"We must make the decision together." -Semi structured interview, Vatovavy Fitovinany, pregnant woman

<u>Decisions on supplement consumption</u>

It was found that women were the primary decision makers related to supplement consumption. It is important to mention that many women noted that their willingness to make decisions related to supplement consumption, alone, was due to the recommendation from the

health professionals at the clinic. For example, when asked who makes the decisions related to consume supplements, a participant responded by stating,

"It's me [who decides], because the midwife and the community worker are advising me about this pill."
-Semi-structured interview, Itasy, Madagascar, pregnant woman

On the contrary to Burkina Faso, while participants highlighted that women primarily made the decision related to supplement consumption, men were the second most frequent group mentioned in making decisions related to supplement consumption. The third most frequently mentioned group categorized as "others", who made decisions related to supplementation, were the mother-in-law, sage femme (midwife), doctors, and health agents. Lastly, participants in both districts cited that they jointly made decisions with their partners regarding supplement consumption.

Decisions to travel to health center

On the contrary, in Madagascar, equally men and women were the primary decision makers regarding traveling to a health center. One of the reasons being mentioned by participants in Itasy and Vatovavy Fitovinany was asking men for permission to travel to the health center was related to finances. As mentioned by one participant,

"I tell him about it, and he gives me permission afterwards to take some money from our cash register."
-Semi-structured interview, Itasy, Madagascar, pregnant woman

In Itasy alone, participants also discussed that they [women] made decisions alone when travelling to the health center. Women cited making decisions alone because they had to attend the clinic if they were not feeling well and emphasized that they were responsible for their own bodies. In Vatovavy Fitovinany, some participants also highlighted making decision alone related to traveling to the health center. It is important to note that one participant highlighted that the decision to attend the hospital was dependent on her marital status, as stated below,

"But if you're not married, you decide to go to the hospital."
-Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

Participants in both districts also mentioned that others, categorized as parents of women and parent-in-law, made decisions related to travel to the health centers. In Vatovavy Fitovinany specifically, contradictory to the above-mentioned statement, participants explained that parents made decisions for women because they were not married, as highlighted by a participant,

"But for the one who is not married, the parents must make the decision."
-Focus group, Vatovavy Fitovinany, Madagascar, pregnant or lactating woman

Lastly, to a lesser extent, participants cited making the decision jointly, as a couple, and one participant even highlighted travelling to the health center with her partner to seek health services.

<u>Compare and contrast the extent to which women have nutrition decision-making autonomy over what they consume during pregnancy in Burkina Faso and Madagascar</u>

Overall, in Burkina Faso men were the primary decision makers on how to spend money and what to eat. Meanwhile in Madagascar, women and men equally decided on how to spend money, and women primarily made decisions regarding what to eat. As for decisions related to supplement consumption, women across both settings made the decision. Lastly, in Burkina Faso, men primarily made decisions related to travel to health center. Meanwhile, in Madagascar, both men and women equally made decisions related to travel to the health center.

Chapter 4: Discussion

To our knowledge, this is the first study to 1) explore what women typically consume in Burkina Faso and Madagascar, 2) investigate nutrition-decision-making among women during pregnancy using the food choice process model, and 3) understand the extent of women's decision-making autonomy in rural parts of Burkina Faso and Madagascar.

Diet finding contextualized with literature

Across both Madagascar and Burkina Faso, participants primarily consumed carbohydrate-rich foods. However, these diets lacked diversity, which is not optimal for women during pregnancy.[138] Specifically, in Burkina Faso, this study found that women primarily consumed *tô*, beans, rice, legumes, and several other vegetables. These findings are similar to other studies conducted in Burkina Faso, where authors investigated diets among women of reproductive age.[32,139,140] Several studies found frequent consumption of cereals such as maize, millet, rice, and vegetables for sauces.[32,139,140] According to de Kok et al., a study conducted in Burkina Faso found that 95% of participants consumed *tô* with a watery sauce containing green leafy vegetables.[141] This finding from de Kok et al., related to *tô* consumption, aligns with our study findings. To a lesser extent, participants highlighted consuming proteins, which corroborated with findings from de Kok and colleagues.[141] An explanation for the low consumption of proteins could be cost. Research has found that the high cost of animal-rich foods is often a barrier limiting consumption.[142]

In Madagascar, specifically, we found that women primarily consumed cassava and rice during pregnancy. The finding on cassava and rice consumption aligned with articles published by Ravaoarisoa et al.[113,143,144] Our study found that women often substituted cassava for rice due to

cost, as cassava was cheaper than rice. One explanation for the high price of rice might be due to low production and seasonality. This statement is corroborated by studies conducted in Madagascar by Ravaoarisoa et al., and Dostie et al. The authors found that cassava is often consumed more than rice during the shortage of production.[113,144] In addition, the spike in prices is primarily found during the lean season – a season with high rates of malnutrition.[145] Given that rice prices in Madagascar rise during the lean season, participants resort to cassava consumption, which increases the chances of malnutrition because cassava's nutritional quality is not sufficient to meet dietary needs.[146] Research has shown that the dietary contribution of rice, particularly in developing countries, is greater (i.e., 29.1% dietary protein) than cassava.[146].

Across both settings, women's typical meals lacked dietary diversity as recommended by the World Health Organization (WHO).[147] According to the WHO, pregnant women are recommended to consume a healthy diet comprised of adequate energy, protein, vitamins, and minerals.[147] These macronutrients and micronutrients can be obtained by consuming balanced meals such as green and orange vegetables, meat, fish, beans, and fruits.[147] Failure to subscribe to an adequate diet during pregnancy can lead to various negative health and nutrition outcomes, including micronutrient deficiencies and poor fetal growth.[10,15,16]

Determinant findings contextualized by the food choice process model with literature

Our study also revealed various factors influencing Burkina Faso and Madagascar maternal nutrition decision-making. Those factors included a variety of personal factors, resources, and social factors that are major influencers of maternal nutrition during pregnancy.

Additionally, we found that personal factors such as food craving and food aversion, across both settings, influenced women's nutrition decisions during pregnancy. Specifically, women in

Madagascar discussed personal factors such as appetite and food preferences to be drivers of their diets. These findings are in line with findings from a review conducted across low- and middle-income countries; researchers found that food preference and food cravings were important personal factors influencing nutrition decision-making.[148] Our findings also revealed that personal factors such as food aversion were often triggered by sensory perception, including smell (i.e., the smell of rice), which caused nausea during the early months of pregnancy. Our results aligned with findings from geographically similar contexts as Burkina Faso and Madagascar (e.g., Tanzania and Nigeria), where women noted avoiding foods such as rice to avoid feeling nauseaous.[149,150]

We found that resources, specifically finances, were a primary factor influencing maternal nutrition in Burkina Faso and Madagascar. Participants in both study sites reported financial constraints that influenced their ability to purchase nutritious foods during pregnancy. Other studies in Madagascar and Burkina Faso found a lack of finances as a major constraint that led participants to select cheaper food options, similar to our findings.[113,151-153] This was likely exacerbated by the COVID-19 pandemic and its impact on households' incomes and employment.[154] The evolving pandemic has impacted food prices and employment across the region of sub-Saharan Africa.[155] This public health situation has caused a reduction in the food supply while demand continues to increase.[155] The food price increase and lack of employment opportunities likely contribute to the influence of resources on women's nutrition decision-making.

Although resources were the most prominent factor reported by participants, social factors, specifically husbands, were also reported to have an impact on women's nutrition decision-making. This was especially pertinent in matters of finances. Our study found that finances influenced household dynamics among spouses. Specific to Burkina Faso, women reported that households

with more finances could manage relationships with their husbands more easily. This finding is corroborated by a report conducted in Burkina Faso by Kieran et al., where women highlighted that more income earned in the household resulted in more understanding between spouses.[64] While the result on more finances and relationship management was found in our Burkina Faso sample and not in Madagascar, a study in a similar geographical context as Madagascar (e.g. Zimbabwe) have found that women who reported an increase in income had reduced the level of domestic conflict.[156] Therefore, improving marriage and power relations between men and women.[156] Perhaps we did not receive this level of detail from participants in Madagascar because they were not probed about the impact of having sufficient money on decision-making.

On the contrary to sufficient resources on relationship management, we also found that minimal resources had the potential to influence relationship management in Burkina Faso and Madagascar. Our finding is similar to a study in Burkina Faso, which found that limited finances often led to women's nutrition requests, which created marital disputes.[157] This household dynamic could be explained by the roles of husbands and men in these two settings, given that Burkina Faso and Madagascar, at large, are patriarchal male-dominant societies.[158,159] The perceived role of gender across these settings often favors men, therefore causing women to rely primarily on their husbands for various items including finances, as we observed in our findings.[159] This imbalance in gender roles has been reported in literature conducted in both Burkina Faso and Madagascar. From the literature, researchers have found that women have limited control on food production and land ownership,[157,158] Therefore, creating negative implications towards income generation.[65,158,159]

Decision-making autonomy findings contextualized with literature

In regard to joint decision-making between couples, participants in Burkina Faso reported zero joint decision-making during inquiries including decisions on how to spend finances and consumption of supplements. Meanwhile, women in Madagascar reported joint decisions related to decisions on how to spend money, what to eat, supplement consumption, and travel to a health center. Although participants did not report findings on joint decision-making in Burkina Faso, Kieran et al., stated that making a joint decision to women in Burkina Faso meant getting along with their husbands, communicating, and discussion of schooling, family health, and well-being.[64] However, men often made decisions alone especially when it related to the use of income.[64] This finding is also reflected in the 2010 DHS report where women mentioned that 75% of men made sole decisions regarding household items.[35] Similarly to our finding, in a qualitative study seeking to understand women's decision-making in Burkina Faso, Beaujoin et al., also found that many women were dependent on the authority of their husbands to make decisions related to items such as traveling to the health facility.[160] Moreover, some literatures in Burkina Faso also indicated that during husbands absence from the household, either due to migration for work or other travels, decisions for women in polygamous households were often made by the oldest wife.[64] This finding is consistent with one of our findings where we found that the first wife often was in charge of deciding how to spend money. The finding on polygamy and decision-making could be explained in Burkina Faso rather than Madagascar because polygamy is widely practiced in Burkina Faso.[63] Meanwhile, in Madagascar, polygamy is illegal.[161]

Unlike the high frequency of men who were found to be prime decision makers based on different inquiries in Burkina Faso, the opposite was observed in Madagascar. In Madagascar, women were either the prime decision makers or a tie was observed where men or women each made decisions, specifically related on how money is spent and travel to health centers. The high

frequency of men having more decision-making autonomy in Burkina Faso than in Madagascar could be due to religious differences; Burkina Faso is a primarily Muslim-dominated country, and Madagascar is predominately Christian.[89,104] Studies have found that being a Muslim can reduce women's authority.[162,163] Conversely, Christian women were found to more likely make their own healthcare decisions than Muslim women.[56]

Our observation of a tie between men and women making decisions in Madagascar is in contrast with the patriarchal society.[73,161] This contrast in finding is critical to consider because research has suggested that once a woman is married in Madagascar, her status as an independent adult is lost, and she must obey her husband and fulfill specific obligations (i.e., house chores and childcare)[73]; therefore, giving men the authority in the household.[159] Failure to follow social norms such as being obedient to one's husband can lead to a woman being shunned.[159] Nonetheless, an explanation for the tie in decision-making power between men and women could be based on the fact that 22% of households in Madagascar are headed by women resulting in a higher frequency of independent decisions.[72] Research conducted in geographically similar contexts such as Malawi has also found that female-headed households often times have higher decision-making power.[156] However, studies suggest that female-headed households are more like to be economically disadvantaged compared to male-headed households.[72,156] Women who have a better socioeconomic status are also more likely to have some level of autonomy.[56] Given that most participants across both settings in our study mentioned that men were responsible for finances in their households, one could infer that this sample might not be autonomous. However, future research using this sample should collect socioeconomic status in order to validate this statement.

In addition, we found that women in both Burkina Faso and Madagascar frequently mentioned being prime decision-makers regarding supplement consumption. An explanation for

why women across both settings are primarily able to make their own decision is because it is personal to the women alone, rather than the household, and does not require the husband's permission. Seymour and Peterman found that women were more likely to report higher levels of autonomy as decisions become more personal (i.e., related to own health problems and family planning), which aligns with our findings.[50] Despite our results indicating that women often make decisions regarding supplement consumption, many studies have found that women still sought their husbands' permission before engaging in activities related to family planning and other personal decisions.[71,160] The reason for this discrepancy in our finding on women's decision making related to supplement consumption and the literature could be due to the difference in perception of supplements compared to family planning. There is a stigma attached to family planning compared to supplements [160]; as such, women might feel the need to seek their husband's permission for one but not the other.[160] That said, little research has been conducted to expand on the understanding of women's autonomy on prenatal supplementation.

Overall, based on our data, we found that many of the decisions made in Burkina Faso were by men. Therefore, implying that women have a lower autonomy level than participants in Madagascar. Perhaps, women often have to allow men to make most decisions in Burkina Faso to reduce conflict[160], such as intimate partner violence.[164,88] Another reason why men make most decisions could be due to the high dominance of Islam in the region. The literature indicated that Muslim women were more likely to have lower decision-making power.[56] Moreover, given the high authority men hold in Burkina Faso, wives who prove to be too independent and do not follow their husbands' directives often were blamed as the cause of conflict.[160,165] Meanwhile, in Madagascar, we found that women either made decisions alone for some items, or there was a tie between men or women making the decision. This result to some extent, can imply that women in

Madagascar have a greater level of autonomy compared to women in Burkina Faso. Perhaps, it could be explained by the increased percentage of female-headed household[72] and the dominance of Christians in the region, of which research indicates that Christian women are more likely to make decisions than women of other religions.[56]

Study strengths and limitations

This study has some limitations. Firstly, the ongoing pandemic of COVID-19 restricted our team from traveling to the field. Therefore, it was difficult to receive a real-time transcript; as a result, data quality was variable. Secondly, in Burkina Faso, two interviewers failed to record; thus, our sample size was reduced to 22 instead of 24. However, we feel confident in our findings because the overall sample was still within the recommended range (20 to 40 individuals in multisite for semi-structured interviews).[134] Thirdly, simultaneous translation and transcription from each Moore and Malagasy to French could have led to a loss of meaning. Lastly, typical food consumption during pregnancy was assessed using free lists and semi-structured interview data. While the recommended 24-hour recall[166] was not utilized to measure and get a more detailed consumption of women's food, two methods were used to corroborate findings.

Despite the limitations, this study had several strengths. First, this project provides an explorative comparative study to contextualize nutrition decision-making for women during pregnancy across two geographically different settings. Secondly, this study utilized the food choice process model, which aided in conceptualizing this study's findings. [122,124] Thirdly, semi-structured interviews, free list, and focus group discussions were used to triangulate findings, as recommended by Miles and Patton. Therefore, this aids in strengthening the validity of findings.[123,124] Lastly, multiple individuals, including local investigators in Burkina Faso and Madagascar, took part in interpreting findings.[167] Therefore, strengthening contextual findings.

Conclusion and future directions

Overall, this study allowed us to identify factors that influence nutrition decision-making and the extent to which women had decision-making autonomy during pregnancy in Burkina Faso and Madagascar. This study allows us to understand more of the nuance around decision-making and autonomy in these settings such as the interconnected factors (e.g., the connection between resources and husbands) identified using the food choice process model that might concurrently drive decision-making autonomy. The ethnographic approach used in this study can be utilized to understand the interconnected factors that the DHS survey might not fully capture in its current form. Future research that seeks to develop a survey instrument to measure decision-making autonomy within Madagascar may need to explore further factors including food context, resource, and social factors. Meanwhile, in Burkina Faso, constructs such as resources and social factors may need to be further explored. Furthermore, understanding the factors influencing nutrition decision-making and autonomy is a start to further investigate the role of women's decision-making autonomy on women empowerment and its influence on outcomes such as maternal nutritional status.

Appendix A: Focus group interview – English

Nutrition information

1. What does a non-pregnant woman usually consume in this community?

2. Can you tell me how women's daily consumption differs during pregnancy?
    a. Probe for other items consumed during pregnancy that you did not consume while you were not pregnant

Responsibilities

3. Now let's talk about typical roles and responsibilities in this community. One thing I heard you mention is food. Could you describe to me who is responsible for deciding what food to buy during pregnancy?

4. Can you describe to me who is responsible for cooking for women in this community during pregnancy?

5. Can you explain to me who is usually responsible for providing money for food?
    a. Probe on who makes the decisions about how the money is spent.
    b. Probe whether it is different if the money is earned by the man or the woman

6. Can you explain to me who decides when you can leave home for health services such as prenatal supplements?

Decision-Making

7. Can you describe the typical decisions that pregnant women have to make every day about nutrition (not just about food, but also about prenatal supplements)?

8. Can you tell me how pregnant women in this community decide what they want to eat each day?

9. Can you tell me about situations where women's decisions about nutrition during pregnancy take precedence over those of their husbands (not just about food, but also about prenatal supplements)?

10. Can you tell me who makes decisions about prenatal supplements (iron folic acid, MMS, iron, etc.) during pregnancy?

Appendix B: Focus group interview – French

Informations liées à la nutrition

1. Que consomme habituellement une femme non enceinte dans cette communauté ?

2. Pouvez-vous me dire en quoi la consommation quotidienne des femmes diffère pendant la grossesse ?
    a. Sondez les autres éléments consommés pendant la grossesse que vous n'avez pas consommés pendant la période où vous n'étiez pas enceinte

Responsabilités

3. Parlons maintenant des rôles et des responsabilités typiques dans cette communauté. Une chose que j'ai entendu que vous avez mentionnée est la nourriture. Pourriez-vous me décrire qui est responsable de décider des aliments à acheter pendant la grossesse ?

4. Pouvez-vous me décrire qui est responsable de la cuisine pour les femmes de cette communauté pendant leur grossesse ?

5. Pouvez-vous m'expliquer qui est généralement responsable de l'approvisionnement en argent pour la nourriture ?
    a. Cherchez à savoir qui prend les décisions sur la façon dont l'argent est dépensé
    b. Sondez si cela diffère si l'argent est gagné par l'homme ou la femme

6. Pouvez-vous m'expliquer qui décide quand vous pouvez quitter la maison pour obtenir des services de santé tels que des suppléments prénataux ?

Prise de décision

7. Maintenant, parlons de la prise de décision. Pouvez-vous décrire les décisions typiques que les femmes enceintes doivent prendre chaque jour en matière de nutrition (pas seulement en ce qui concerne la nourriture, mais aussi les suppléments prénataux) ?

8. Pouvez-vous me dire comment les femmes enceintes de cette communauté décident de ce qu'elles veulent manger chaque jour ?

9. Pouvez-vous me parler des situations où les décisions des femmes en matière de nutrition pendant la grossesse passent avant celles du mari (pas seulement en ce qui concerne la nourriture, mais aussi les suppléments prénataux) ?

10. Pouvez-vous me dire qui prend les décisions concernant la consommation des suppléments prénataux (fer acide folique, MMS, fer, etc.) pendant la grossesse ?

Appendix C: Semi-structured interview – English

Nutrition information

1. What did you consume daily in this house when you were not pregnant?

2. Can you tell me how your daily intake differs during pregnancy?
    a. Probe for other consumables taken during pregnancy that you did not take during the non-pregnancy period

Responsibilities

3. Now let's talk about typical roles and responsibilities in this house. One thing you have (heard or not) is food. Could you describe for me who is responsible for deciding what foods to buy during pregnancy?

4. Can you describe to me who is responsible for the cooking during your pregnancy?

5. Can you explain to me who is generally responsible for providing money for food during pregnancy?
    a. Probe who makes the decisions about how the money is spent
    b. Probe if it differs if the money is earned by the man or the woman

6. Can you explain to me who decides if you can leave the home to get supplements?

Decision-making

7. Now let's talk about decision-making. Could you describe the typical decisions that you had to make every day as a pregnant woman (not just regarding food, but also prenatal supplements)?

8. Can you tell me how you decided what to eat each day during your pregnancy?

9. Can you tell me about situations where your decision goes beyond the husband's decision about nutrition (not just food, but prenatal supplements as well)?

10. Can you tell me who makes the decisions about taking prenatal supplements (folic acid, MMS, iron, etc.) during pregnancy?

Appendix D: Semi-structured interview – French

Informations liées à la nutrition

1. Que consommiez-vous quotidiennement dans cette maison quand vous n'étiez pas enceinte ?
2. Pouvez-vous me dire comment votre consommation quotidienne diffère pendant la grossesse ?
    a. Sondez les autres éléments de consommation pris pendant la grossesse et que vous n'avez pas pris pendant la période de non-grossesse

Responsabilités

3. Parlons maintenant des rôles et des responsabilités typiques dans cette maison. Une chose que vous avez (entendue ou non), c'est la nourriture. Pourriez-vous me décrire qui est responsable de la décision concernant les aliments à acheter pendant la grossesse ?
4. Pouvez-vous me décrire qui est responsable de la cuisine pendant votre grossesse ?
5. Pouvez-vous m'expliquer qui est généralement responsable de l'approvisionnement en argent pour la nourriture pendant la grossesse ?
    a. Sondez qui prend les décisions sur la façon dont l'argent est dépensé
    b. Sondez si cela diffère si l'argent est gagné par l'homme ou la femme
6. Pouvez-vous m'expliquer qui décide si vous pouvez quitter le foyer pour obtenir des suppléments ?

Prise de décision

7. Maintenant, parlons de la prise de décision. Pourriez-vous décrire les décisions typiques que vous deviez prendre chaque jour en tant que femme enceinte (pas seulement en ce qui concerne la nourriture, mais aussi les suppléments prénataux) ?
8. Pouvez-vous me dire comment vous avez décidé de ce que vous alliez manger chaque jour pendant votre grossesse ?
9. Pouvez-vous me parler des situations où votre décision dépasse celle du mari en matière d'alimentation (pas seulement en ce qui concerne la nourriture, mais aussi les suppléments prénataux) ?
10. Pouvez-vous me dire qui prend les décisions concernant la consommation de suppléments prénataux (acide folique, MMS, fer, etc.) pendant la grossesse ?

Appendix E: Free List – English

Data Collector Name:_____ Date: _____Region: _____
Date:_____CSPS:_____Respondent's characteristics: Age ____
Respondent characteristics: Age: ____ gestation age (months): _____Number of Children:____

No.	Free List Question	Comments to guide field notes
	List all of the different foods that pregnant women consume in this community.	• List the foods: *Note: Please give the local name with its French equivalent in parenthesis*
	Probe on the top 5 foods mentioned to determine well as a description of that food in general. • **You might probe about their availability by season.** • **Probe on any foods that seem confusing, new, or unclear to you for further clarification.**	
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Appendix E : Free List – French

Nom du collecteur de données :_____Date :_____ Région :_____
District :_____ CSPS :_____ Caractéristiques des répondants : Age : _____
Age de la grossesse (en mois) : _____ Nombre d'enfants vivants:_____

No.	Question de Free List	Commentaires pour guider les notes de terrain
	Énumérez tous les différents ALIMENTS que les femmes enceintes CONSOMMENT dans cette communauté.	Lister les aliments : *Note : Veuillez donner le nom local avec entre parenthèse son équivalent en français*
	Sondez sur les 5 principaux ALIMENTS cités : • **Sonder sur la description de cet aliment (couleur, décrire les principaux éléments qui le composent, le goût, est-ce un aliment disponible à tout moment ou est-il saisonnier).** • **Sonder sur les raisons pour lesquelles les femmes enceintes CONSOMMENT cet aliment.**	
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Appendix F : Codebook

	No.	Brief Code Name	Full description of code	When to use the code
1.0 Diets prior and during pregnancy				
1	1.1	**Diets of non-pregnant women**	Description of daily dietary consumption of non-pregnant women	Use this code when participants are discussing what non-pregnant women consume
2	1.2	**Diets of pregnant women**	Description of daily dietary consumption of pregnant women	Use this code when participants are discussing what pregnant women consume
3	1.2.1	**Healthy foods**	Description of healthy foods pregnant women consume	Use this code when participants are discussing healthy foods consumed by pregnant women (i.e.: when participants link foods to vitamins)
2.0 Influencing factors on decision-making with regard to supplement and food choice				
4	2.1	**Ideals**		Use this code when participants discuss expectations, standards, hopes and beliefs (cultural and symbolic factors)
5	2.2	**Personal factors**	Description of Personal factors to food choice	Use this when participants discuss items including likes/dislikes, individual food styles, demographic factors (age, health status, gender, sensory preferences), state of hunger, cravings, food preferences, aversions influence decision-making
6	2.3	**Resources (finances)**	Description of when resources influence decision-making	Use this code when participants are discussing when finances, skills, and time influenced decision-making
7	2.4	**Social Factors**	Description of when family and other individuals influence decision-making	Use this code when participants are discussing when family and other individuals influence decision-making
8	2.4.1	**Men influence the decision**	Description of when men influence decisions	Use this code in situations when men (husbands or partner) influence decisions

9	2.4.2	**Others influence the decision**	Description of when other individuals influence decisions	Use this code in situations of when other individuals (e.g: in-laws, other family members, friends, doctor, religious figures) influence decisions
10	2.5	**Food context**		Use this code participants discuss physical surrounding and social climate, availability, seasonal or market factor
3.0 Decision-making with regard to supplement and food choice				
9	3.1	**Women make decisions**	Description of situations when women decide on diet and supplement related decision	Use this code in situations when women make decisions
10	3.2	**Men make the decision**	Description of situations when men decide	Use this code in situations when men (husbands or partner) make decisions
11	3.3	**Couples jointly make the decision**	Description of situations when decisions are made jointly by couples	Use this code in situations when couples jointly make decisions
12	3.4	**Others influence the decision**	Description of when other individuals influence decisions	Use this code in situations of when other individuals (e.g: in-laws, other family members, friends, doctor, religious figures) influence decisions

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