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Elucidation of Dietary Intake and Craving Patterns of Pregnant Women at 12-26 Weeks of Gestation: A Cross-Sectional Study in Mid-Western Uganda

Margaret Kiiza Kabahenda*¹ 

¹Department of Food Technology and Nutrition, Makerere University, P O Box 7062, Kampala, Uganda.

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ABSTRACT

While cravings have historically been documented among pregnant women globally; it remains unclear why women in different contexts crave specific food and non-food items. This cross-sectional survey sought to characterize the dietary practices and craving patterns of resource-constrained pregnant women (N=925) living in a rural context in mid-western Uganda. Women's health and nutritional status were assessed using anthropometric and biochemical measures plus clinical examinations while, craving patterns and dietary intake were assessed through in-depth structured interviews by trained enumerators.

Cravings were reported by 60.4%, and most women craved for meats. Among those with pica, amylophagy was more prevalent as indicated by craving for raw cassava (31.1%), sundried cassava chips or flour (16%), maize flour (14.1%), and sorghum flour (4.2%). Geophagy was documented among 10.3%; and these craved for soil, molded clay, and wall chippings. Overall, the number of items craved (diversity of cravings) and reports of amylophagy were negatively associated with dietary diversity. However, neither food nor non-food cravings were associated with maternal anemia and fetal size. Further analyses of cravings by food groups revealed that a significantly higher proportion of women in early pregnancy (≤ 20 weeks of gestation) craved for fruit than those that were greater than 20 weeks of gestation (30.0% vs. 14.8%; $X^2 = 6.699$; $p = .010$). Additionally, primigravida craved a significantly higher number of non-food items (Mean = 1.84 ± 1.20 ; 95%CI: 1.53, 2.14; $p = 0.015$) than women who had experienced other pregnancies (Mean = 1.52 ± 0.83 ; 95%CI: 1.42, 1.62). Given the low dietary diversity documented in this study, 'giving in' to food cravings may help improve pregnant women's caloric and micronutrient intake, and possibly improve pregnancy outcomes. However, interventions are needed to improve pregnant women's awareness of the dangers associated with both food and non-food cravings, including amylophagy, geophagy, and other risky dietary and craving practices.

*Corresponding author

E-mail: margaret.kabahenda@mak.ac.ug (Kabahenda Margaret K.)

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1. INTRODUCTION

Pregnancy is characterized by many physiological changes that affect the nutritional needs of pregnant women (Most et al., 2019; Soma-Pillay et al., 2016). These physiological changes can negatively influence a pregnant woman's nutritional status and health, particularly when dietary intake is inadequate or fails to meet the increased caloric and nutrient requirements for a healthy pregnancy. Conversely, food cravings and aversions are common among pregnant women and have been reported from different contexts in Africa (Demissie et al., 1998; Kariuki et al., 2016; Myaruhucha, 2009). Although the exact cause of cravings remain unclear, cravings seem to serve as physiological control mechanisms by which pregnant women seek some food components to maintain good nutrition while avoiding potentially harmful substances such as teratogens or abortifacient components (Nordin et al., 2004; Orloff & Hormes, 2014). Cravings and aversions also seem to help women to adapt to pregnancy-induced changes in smell and taste perceptions (Nordin et al., 2004). Although several studies have documented craving patterns and possible reasons why women crave or have aversions to certain foods and non-food items (Bayley et al., 2002; Madziva & Chinouya, 2020; Mercer & Holder, 1997; Placek & Hagen, 2015; Placek et al., 2017; Rodríguez-Martín & Meule, 2015); it remains unclear why women in different contexts crave for specific food and non-food items.

Research indicates that cravings are facilitated by an interplay of socialization, behavioral, psychological, and physiological factors (Bowen, 1992; Madziva & Chinouya, 2020). According to Orloff and colleagues (Orloff et al., 2016), food cravings among pregnant women help to address changes in sensory perceptions effected by alterations in hormonal secretions, counteract nutritional deficits, aid in obtaining pharmacologically active ingredients in the desired foods, and/or fulfill social and cultural expectations. Pregnancy-induced alterations in sensory perceptions (Nordin et al., 2004; Soma-Pillay et al., 2016) and associated episodes of nausea, vomiting, aversion, and cravings are well documented (Bayley et al., 2002; Myaruhucha, 2009; Steinmetz et al., 2012; Weigel et al., 2011). Regardless of the cause, cravings need to be understood because they have both negative and positive impacts on pregnancy outcomes.

The 'nutritional deficit' hypotheses are supported by research that suggests that people tend to crave for foods that are restricted in their diets (Demissie et al., 1998; Mercer & Holder, 1997) and that craving is associated with diet quality and poor dietary patterns characterized by long intervals between meals (Taetzsch et al., 2020). Research also indicates that even satiated adults adhering to a monotonous but nutrient-dense diet are also more inclined to crave for their favorite food than adults on a varied diet (Pelchat et al., 2004). These findings indicate multiple reasons on why pregnant women crave. The high prevalence of food cravings reported in resource constrained contexts suggests

that nutritional deficit may also be a major driver for food craving during pregnancy in these settings (Demissie et al., 1998; Handiso, 2015; Kariuki et al., 2016; Myaruhucha, 2009). The differences in the types of foods that women crave in resource-constrained contexts (Demissie et al., 1998; Handiso, 2015; Kariuki et al., 2016; Myaruhucha, 2009) when compared with more developed contexts (Esper, 2015; Farland et al., 2015; Hill et al., 2016; Hook, 1978; Massey & Hill, 2012) suggest that craving may be a mechanism to meet the increased caloric and nutrient needs among those adhering to nutritionally restrictive diets (Most et al., 2019; Soma-Pillay et al., 2016). The major concerns about food cravings during pregnancy are increasingly centered on the increase in gestational weight gain (Orloff et al., 2016) and its negative impact on fetal and maternal birth outcomes (Blau et al., 2020; Hill et al., 2016; Massey & Hill, 2012). There are also concerns that cultural norms associated with pregnancy can result in food restrictions and promotion of certain dietary practices that may limit the intake of some important foods (Placek & Hagen, 2015; Placek et al., 2017) and promote consumption of non-food items or pica (Baum et al., 2020; Handiso, 2015; Myaruhucha, 2009; Nakiyemba et al., 2021). This calls for more research to improve the understanding of foods and non-food items that are craved by pregnant women in different contexts.

The available literature also reveals geographical, cultural, and ethnic variations in food aversions and the types of food craved during pregnancy (Demissie et al., 1998; Hainutdzinava, 2017; Orloff & Hormes, 2014); however, there are no specific trends in dietary patterns that can inform interventions to boost the dietary intake of pregnant women in different settings. Hence, the purpose of this study was to characterize the dietary practices and craving patterns of resource-constrained pregnant women living in a rural context in mid-western Uganda, where livelihoods are centered on subsistence farming, supporting monotonous diets. Since rural populations tend to uphold traditional practices (Cantor et al., 2013; Dehury et al., 2018; Ikechukwu et al., 2020), it was hypothesized that older women (25 years or older) would report craving for more non-food items and foods with attached cultural values since they are more versed with cultural norms than younger women. Additionally, in recognizing food cravings as a possible response to *nutritional deficits* (Orloff & Hormes, 2014), it was hypothesized that women in early pregnancy (≤ 20 weeks of gestation or maternal anabolic phase) would report more cravings than those in late pregnancy (≥ 21 weeks of gestation or maternal catabolic phase) because of the higher micronutrient needs in early gestation.

2. METHODS

2.1 Study area

An exploratory cross-sectional survey was conducted in five districts of mid-western Uganda: Kabarole, Kamwenge, Kasese,

Kibale, and Kyenjojo. Two health center III facilities were purposively selected from each district based on the estimated number of pregnant women in their catchment areas.

2.2 Study population and eligibility

The study targeted women that attended the public health centers for antenatal care. The study population was comprised of rural women whose major activity was subsistence farming. Village Health Team members (commonly referred to as VHTs) at the selected health center (HC) listed all the pregnant women within the catchment area. The lists provided were then used to shortlist eligible women who were invited to one-day antenatal checkups held at their HCs.

Only pregnant women that were determined to be healthy after a thorough medical examination by the medical officers and midwives and women that were also within 12–26 weeks of gestation (wGA) were included in this study. Based on screening at recruitment, these women can also be described as resource-constrained. More details about the study participants are reported elsewhere (Kabahenda & Stoecker, 2024).

2.3 Sampling and sample size determination

This study was part of the baseline data collection for action research that had a predetermined goal of reaching and improving pregnancy outcomes among 1000 women. Hence, a convenience sample of 200 women was targeted from each district. Within each district, the number of women recruited from each health center (HC) was proportional to the reported expected population of antenatal cases - which was obtained from HC population statistics posted at each facility.

2.4 Data collection

2.4.1 Description of study tools and data collectors

Data was collected using a structured questionnaire which was comprised of five major sections. To enhance data quality, the assessment was divided into 5 major segments and each segment constituted an assessment station and had a specific section of the questionnaire. An extra station was added for logistical purposes. Hence, the six assessment stations were: (i) welcoming participants and obtaining their informed consent; (ii) collection of sociodemographic data and taking anthropometric measurements (triage); (iii) usual antenatal assessment plus a head-to-toe clinical examination for signs of malnutrition; (iv) assessment of maternal access to and utilization of healthcare services; (v) in-depth interviews on craving patterns, dietary practices, and changes in dietary intake; and (vi) checking data and disbursement of incentives. The questionnaires were color-coded to match flags posted at each assessment station to ease movement of participants. Each assessment station was staffed with professionals who had also undergone a 5-day training in data collection. The trained enumerators included postgraduate

nutrition students and a phlebotomist plus assistant medical officers (clinical officers), midwives, and nurses that were working in the participating health centers.

2.4.2 Assessment of women's health and nutritional status

Each woman underwent a thorough physical examination as part of routine antenatal care and this included measurement of fundal height. The head-to-toe approach (Esper, 2015) was followed to assess clinical signs of malnutrition. Key assessments included examination of the eyes for conjunctiva pallor and ocular signs of vitamin A deficiency, the mouth for clinical signs of B-vitamin deficiencies, neck for presence of goiter, hands for palm and nail-bed pallor plus presence of jaundice, abdomen for determining fetal positioning and assessment of fundal height, and legs and feet for signs of edema and pellagrous dermatitis.

Maternal nutritional status was also determined by quantifying hemoglobin levels in capillary blood following protocol described in the HemoCue 301 Operating Manual (HemoCue_AB). Two-three drops of capillary blood were drawn from each woman by finger prick and used to quantify maternal hemoglobin (Hb) level using Hemocue Hb 301 photometers (Hemocue AB, Angelholm Sweden). The measured hemoglobin was adjusted for altitude of data collection area. Then the level of each woman's risk of anemia was classified as severe, moderate, mild, and not anemic using adjusted hemoglobin cut-offs of <70, 70–94.9, 95–104.9, and 105 g/L or higher, respectively (WHO, 2024). Fetal growth was used as one indicator of positive pregnancy outcomes and was estimated using symphysis fundal height z-scores calculated using INTERGROWTH-21st fetal growth standards (Papageorgiou et al., 2018; Papageorgiou et al., 2016) as described elsewhere (Kabahenda & Stoecker, 2024).

2.4.3 Assessment of women's dietary intake

Participants were asked to report the number of regular household meals, number of special meals they prepared for themselves daily, the number of snacks consumed regularly, and their perceptions of changes in amounts of food they ate. Additionally, women's dietary diversity (WDDS) was assessed using a 24-hour dietary intake recall as described by FAO and collaborators with context-specific adaptations (FAO & FANTA, 2016; Swindale & Bilinsky, 2006; UBOS & ICF, 2011, 2018). During data processing and analysis, the 21 food groups were further condensed into nine groups: *starchy staples* (composed of grains and roots, tubers, and green bananas); *dark green leafy vegetables*; *other vitamin A-rich fruits and vegetables*; *other fruits and vegetables*; *pulses, nuts and seeds*; *flesh meats* (all meats including poultry); *organ meats*; *fish and seafood*; *milk and milk products*; and *eggs*. The scores on each of the 9 WDDS food groups were summed and then categorized to generate a total of 9 possible points; and these scores were used to define

women's level of dietary diversity as 'low' (1-3 groups), moderate (4-5 groups), and adequate (6 groups or more).

2.4.4 Assessment of craving patterns

Craving (locally called *kwoya*) was operationalized as a 'strong desire' to consume a certain food or non-food item (Blau et al., 2020; Kozlowski & Wilkinson, 1987). A list of commonly craved items was generated from focus group discussions and key informant interviews. Hence, the women were asked to report whether they had craved any of the food and non-food items listed during their last or current pregnancy. This list of potentially craved items also included the option for 'Other' where women were asked to mention all foods and food combinations that they had craved eating. Since the individual foods mentioned under 'Other' were more than expected, food group variables were created into which the individual foods were entered. The 10 food groups created were: (i) *grains*; (ii) *roots and tubers*, (iii) *dark green leafy vegetables*, (iv) *dairy products* (milk and milk products, including cheese and ice cream), (v) *meats*, (vi) *organ meats*, (vii) *fish*; (viii) *eggs*, (ix) *fruits*, and (x) *other vegetables*. Each individual food item under *Other* was then entered into their respective food groups. Where the participants described mixed dishes such as pottages/stews or a staple food complemented by a relish, the major ingredients were entered into their respective food groups.

2.5 Statistical analysis

Descriptive statistics, such as means and frequencies, were computed to describe the participants, their dietary diversity, and cravings. Analyses of variance tests were performed to determine differences in means of continuous variables across groups. To test the hypotheses that women's craving practices differed by age and gestation stage (wGA), women were categorized into the following groups: younger (15-24 years) versus older (25-43 years), early mid-pregnancy or maternal anabolic phase (12-20 wGA) versus late mid-pregnancy or maternal catabolic phase (21-26 wGA), and anemic versus not anemic. Chi-square tests were then used to determine the significance of the differences in the proportion of women engaged in specific practices.

Ethical considerations

The research protocol was reviewed by the Makerere University School of Medicine Ethical Review Committee (REC REF 2012-170) and approved by the Uganda National Council of Science and Technology (Ref. HS 1292). Informed written consent was obtained from all participants who could read and write before data collection. Those who could not read or write were asked to affirm their consent with a fingerprint, and this process was witnessed by an educated relative or local leader. Additionally, women were also asked to provide consent for specific assessment procedures at individual assessment stations. Notably, extra consent was sought for (i) the head-to-toe physical examination since it was an addition to the routine antenatal check-up, (ii) drawing blood sample for hemoglobin

determination, and (iii) participating in an in-depth interview about their food intake, cravings patterns, and dietary practices. During the assessment, women diagnosed with anemia based on Hb level <10.5 g/dL, conjunctiva pallor, or nailbed refill and those with other clinical signs of nutrient deficiency were prescribed medicines available at the HC and then referred to the closest Health Center IV for further intervention.

3. RESULTS AND DISCUSSION

3.1 Characteristics of study participants

A total of 925 pregnant women participated in the study; however, data from 17 women were excluded because their self-reported last menstrual cycle and measured symphysis fundal heights indicated that their pregnancies were < 12 or > 26 weeks of gestation (wGA). Data from 12 women were excluded because they did not consent to participate in at least one assessment. **Table 1** provides details about the study participants. Overall, maternal ages ranged from 15 to 43 years, and 59.4% were still in the maternal anabolic phase (≤ 20 wGA), whereas 40.6% were in early maternal catabolic or fetal anabolic phase (21-26 wGA). Based on fundal height z-score categorizations (Pay et al., 2016), 15.8% of pregnancies were classified as low growth rate (at risk of small-for-gestation age) and only 0.7% were potentially large-for-gestation age (**Table 1**). More details about the study participants are reported elsewhere (Kabahenda & Stoecker, 2024).

3.2 Women's meal patterns

In general, the household meal patterns reported by women included in the current study were reflective of limited eating occasions, as documented in national surveys (UBOS & ICF, 2011, 2018). About one half of women (48.6%) reported an average of three meals being consumed in their households daily, 39.3% reported two meals, 4.2% reported one meal, and the remaining 7.9% could not quantify their meal patterns. To supplement the household meals, 43.3% women indicated that they prepared special meals for themselves, and the majority of them (83.9%) prepared 1-2 special meals daily. Similar to commonly reported household meal patterns in Uganda (UBOS & ICF, 2018) the special meals that women prepared for themselves were mainly comprised of the starchy staples such as Irish potatoes (37.8%), sweet potatoes (32%), millet porridge (21.7%), cassava meal or *makahunga* (32.5%), and maize meal or *posho* (16.1%). A few women supplemented their diets with easily accessible foods such as store-bought tea biscuits (9.7%) and fruits (2.8%). Although protein-rich foods were limited to household diets, only 4.3% reported that they supplemented their diets with meat, fish, or poultry and only 2.7% had special servings of dairy products (milk or yoghurt). Nine women (1%) had received corn-soy blend and/or a peanut-based ready-to-use therapeutic food (RUTAF, an equivalent of Plumpy Nut) from the health facilities as supplemental feeds to manage their undernutrition. The fact that 1% reported having a history of

being undernourished and being treated with food supplements indicates that pregnant women in these settings should be prioritized for nutritional monitoring and intervention. This may also require improving the pregnant women's access to nutrient-dense snacks to supplement regular household meals.

3.3 Diversity of women's diets

In general, the participants' diets were limited in dietary diversity (Mean WDDS = 4.38 ±1.92), which is an indicator of food and

nutrition insecurity. Only 25.2% had adequate diets comprising of 6 or more food groups (FAO & FANTA, 2016). **Figure 1** indicates that almost three quarters of the participants (74.7%) had consumed 5 food groups and half of these (37.0%) had less than 3 food groups which indicates low dietary diversity. Although the proportion of women with low and moderate WDDS is lower than has been reported in this region (85.9%) and among pregnant women in Uganda (90%) (Kimuli et al., 2024); this is a major concern since low dietary diversity has been associated with nutrient inadequacy (Apprey et al., 2025; Puwanant et al., 2022; Yeneabat et al., 2019)

Table 1. Participant characteristics and clinical presentations of malnutrition

Characteristic and clinical presentation of malnutrition	Total assessed (N=896)	Distribution of women by districts				
		Kasese (n=171)	Kyenjojo (n=186)	Kamwenge (n=183)	Kabarole (n=157)	Kibale (n=199)
Mean maternal age (years) ± SD (Min-Max)	25.4±5.9 (15-43)	24.5±5.7 (15-40)	25.2±6.1 (17 - 41)	25.7±6.2 (16-43)	24.4±5.8 (17-40)	26.1±5.9 (15-40)
Mean gestation age (weeks) ±SD	19.8±3.7	20.2±4.2	20.3±3.3	18.4±3.4	20.5±4.0	19.7±3.1
Estimated fetal growth rate based on fundal height z-score (%):						
Low growth (<-3)	4.8	1.5	8.2	7.0	0.8	6.0
Moderate growth rate (-2 to -3)	11.0	6.2	17.2	4.3	12.7	13.5
Normal growth rate (-2 to 2)	84.0	92.3	73.9	88.7	85.6	80.5
Possibly LGA (>4)	0.3	0	0.7	0	0.8	0
% Anemic as diagnosed by:						
Hemoglobin <105 g/L (adjusted) ^a	38.9	51.5	31.3	30.9	34.7	45.2
Conjunctival pallor	7.1	0.6	3.7	14.7	4.9	11.6
Nail-bed pallor (low capillary refill)	5.7	5.0	1.1	11.2	1.8	9.0
Reported poor adaptation to light (night blindness) (%)	0.6	0	1.1	0	1.8	0.5
Had pellagrous dermatitis (%)	1.1	3.4	0	0	2.4	0
Dietary intake:						
Mean number of meals/day ±SD	2.50±0.61	2.72± 0.51	2.49±0.56	2.48±0.50	2.54±0.74	2.48±0.62
%Prepare extra special meals	43.3	59.8	36.4	41.7	48.1	32.6
Mean WDDS ± SD	4.38±1.92	4.40±1.87	3.95±1.61	4.38±1.76	4.59±2.08	4.59±2.15
Had adequate WDDS	25.4	24.1	19.7	25.3	26.9	30.6
Reported eating less than usual (%)	45.9	35.5	44.3	48.4	49.0	51.8
Reported eating more than usual (%)	14.0	15.7	22.2	13.4	7.6	10.7
Craving practices during current pregnancy (%):						
Reported any cravings	60.4	62.6	59.4	62.7	61.6	56.5
Craved for non-food or raw food	39.9	49.0	37.6	37.9	38.4	37.9
Craved for food	25.1	18.1	27.4	27.3	33.1	22.1

Notes: ^a Hemoglobin was adjusted for altitude following WHO guidelines(WHO, 2024)

Abbreviations: SD, standard deviation; WDDS, women's dietary diversity score; LGA, large-for-gestation age.

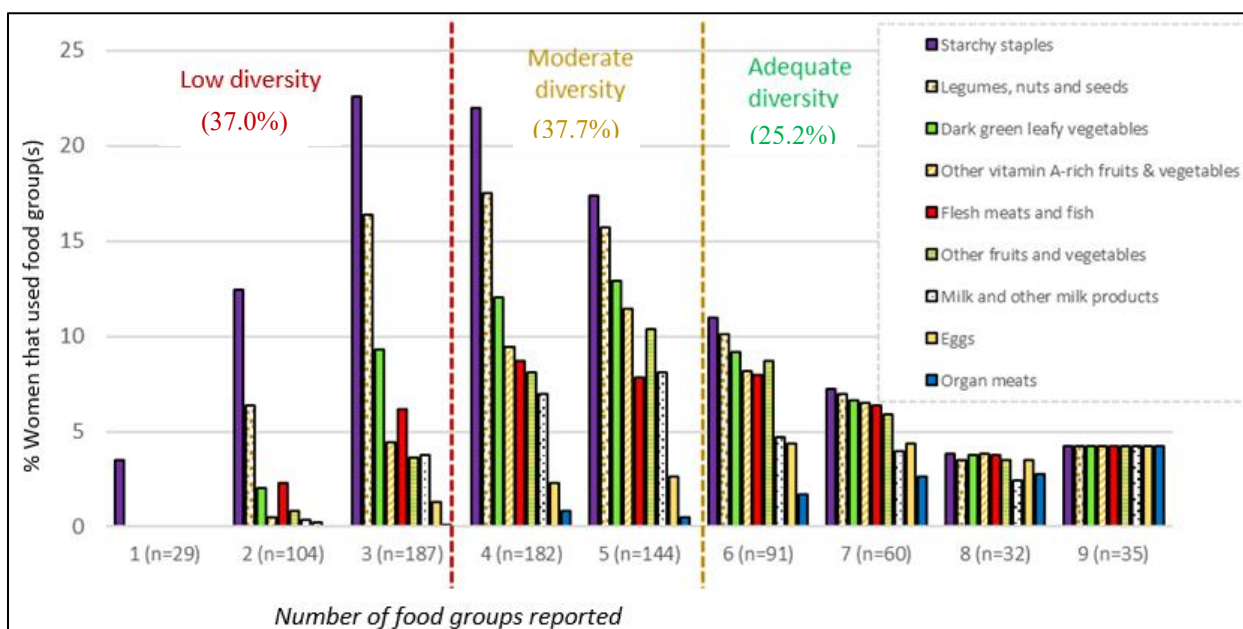


Fig. 1. Proportion of pregnant women with the specified dietary diversity

Despite the increased protein and micronutrient needs among pregnant women (Soma-Pillay et al., 2016), **Figure 1** shows that household diets had limited animal-source foods. The commonly consumed foods were *starchy staples*, *legumes and nuts*, and *dark green leafy (DGL) vegetables*. Only 65.9% of women reported incorporating at least one animal-source food in their diets the day preceding the survey. *Dairy products* and *eggs* are relatively the cheapest animal-source foods in Uganda; however, only 32.2% and 21.5% reported consuming milk and eggs, respectively. Based on key informant interviews with health workers in the study area, *organ meats* are often promoted by health workers among pregnant women as a good source of most nutrients but only 12.5% of the respondents reported consuming liver and offal (tripe).

3.4 Prevalence of pica and food cravings among pregnant women

A total of 606 out of 825 women (73.4%), who were interviewed on craving patterns, reported experiencing cravings in their last pregnancy that resulted in a live birth; and 514 of these (84.8%) reported craving for food items (see Figure 1). A similar trend was observed in women's reports of cravings in current pregnancies whereby 60.4% (498) had already craved for something at 12 to 26 weeks of gestation, and the majority of these (45.2%) also craved for foods. The commonly craved foods in both past and current pregnancies also indicate similar patterns whereby the majority of women reported craving for meats, grains, roots and tubers, and fruits. This could be partly

explained by limited inclusion of meats, grains (especially rice), and fruits in the diets (**Figure 1**).

Conversely, pica was also reported in both the past and current pregnancies. As shown in **Figure 2**, amylophagy (craving starch) was the most predominant type of pica reported in both pregnancies. Notable proportions of women craved for raw cassava (31.1%), sundried cassava chips or flour (16%), maize flour (14.1%), and sorghum flour (4.2%) in the current pregnancy. The prevalence of geophagy mostly indicated by craving for soil (13.9%) and wall chippings (7.7%), was low but raises a concern of potential ingestion of harmful substances. Clay, charcoal, laundry detergent, and commercial starch, which are commonly cited non-food items in the literature (Hook, 1978; Madziva & Chinouya, 2020; Rainville, 1998), were consumed by very few women in the current study – which could be explained by limited access to these items.

The large difference in the proportions of women that craved for food items (see *Other* in **Figure 2**) in the past versus the current pregnancy can be explained by the fact that current pregnancies reflect only cravings at 12-26 weeks of gestation – which excludes craving in early (0-11 wGA) and late (27-40 wGA) pregnancy. Nevertheless, the high prevalence of food cravings documented in the current study (at 12-26 wGA) may be associated with low dietary diversity. Notably, there was a weak but statistically significant negative correlation between total dietary diversity scores and the total number of items craved ($r_p = -0.185$, $p < 0.001$) which suggests that women with less diverse diets craved for a large number of food and non-food items. Further analyses revealed that the level of craving both food and

non-food items was low among women that included eggs ($r_s = -0.145$, $p < .001$), dairy products ($r_s = -0.146$, $p < .001$), dark-green leafy vegetables ($r_s = -0.091$, $p = 0.024$), and those that had a variety of vitamin A-rich foods ($r_s = -0.114$, $p = 0.017$) and starchy staples ($r_s = -0.096$, $p = 0.018$). These findings suggest that having less diverse diets may increase the risk of craving for both food and non-food items (pica). Additionally, the fact that most women reported craving for food combinations consumed often by affluent households in rural areas (see section on *Less frequently consumed foods* in Table 2) suggests that pregnant women in limited-resource contexts are likely to crave for foods that are less accessible to them or food combinations consumed less frequently.

As shown in **Figure 2**, meat was the most craved food item in previous pregnancies and during the current pregnancies (at 12-26 wGA); however, meat consumption was neither related to craving nor to the number of items craved. **Figure 3** below further reveals that flesh meats and fish were the most craved and yet focus group discussions and key informant interviews highlighted organ meats, such as liver and offal (tripe), as the most craved items. This is not surprising since meats and fish have also been reported as the most craved foods among other resource-constrained populations (Demissie et al., 1998; Handiso, 2015; Myaruhucha, 2009)

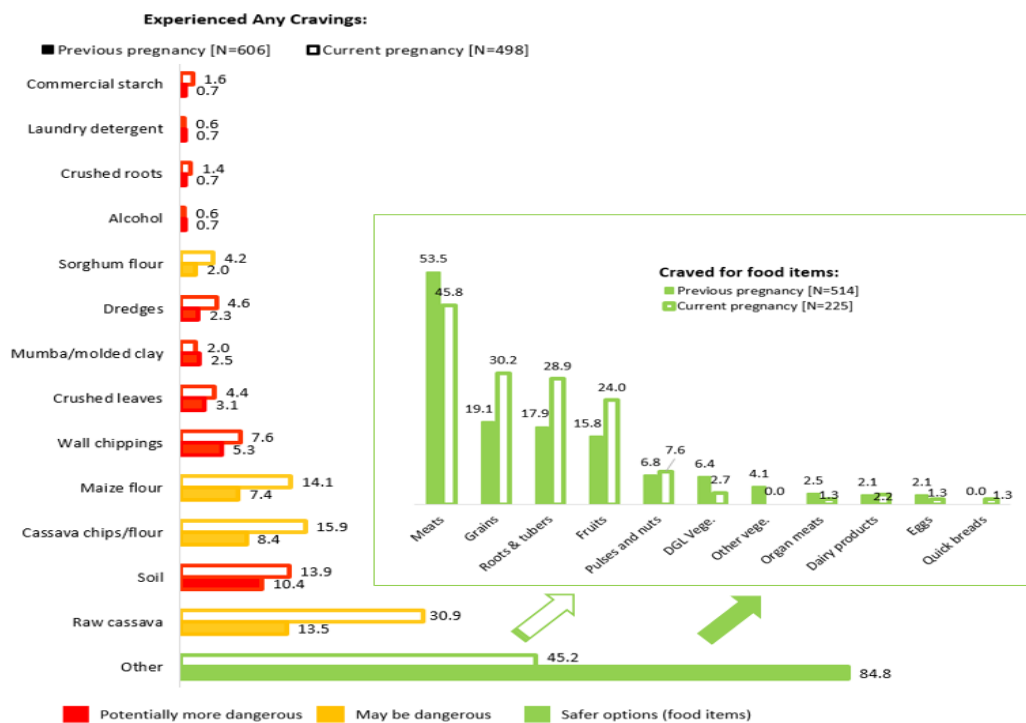


Fig. 2. Proportion of women that reported craving for non-food and food items during current and previous pregnancies

It is important to note (see **Figure 3**) that the majority of women craved for ‘any meat’ and ‘any fish’; which indicates that they did not have craving for specific types of meats or meat products. This calls for interventions to improve meat and other animal source food access by pregnant women.

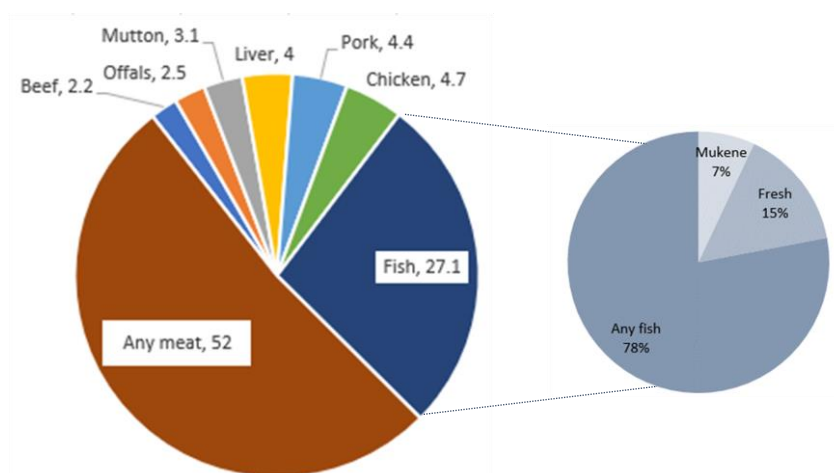
3.5 Patterns in craving for food and non-food items

In developed countries, food cravings during pregnancy are a concern due to increased possibility of excessive calorie intake and high pregnancy weight gain (Orloff & Holmes, 2014), and the associated risks of poor maternal and fetal pregnancy outcomes (Blau et al., 2020; Hill et al., 2016; Massey & Hill, 2012). Conversely, cravings during pregnancy are a public

health concern in limited resource contexts because some craving practices pose a risk of consumption of potentially toxic components that can impair fetal growth and development (Baum et al., 2020; Myaruhucha, 2009; Nakiyemba et al., 2021; Placek et al., 2017). For example, craving for starch (amylophagia) seems beneficial among women with limited dietary intake; however, the types of starch products used to quench this craving can result in poor pregnancy outcomes. Notably, although craving for raw cassava and sun-dried cassava chips might be a cultural or pharmacological need to avert nausea and vomiting, raw cassava and large sundried raw cassava chips

may contain hydrogen cyanides that negatively affect fetal growth and development (Ndubuisi & Chidiebere, 2018). Hence, there is need for interventions to reduce pregnant women's engagement in amylophagia – which was the most widespread form of pica in this study. The association of amylophagia with low dietary diversity ($r_s = -0.114$, $p = 0.001$)

and low consumption of meats and fish ($r_s = -0.095$, $p = 0.007$), and with vitamin A-rich foods ($r_s = -0.088$, $p = 0.032$) documented in this study suggests that improving dietary diversity and diet quality might reduce cravings for raw starchy food products.



Note: Mukene or *Rastrenaebola argentea* is small fish that is cheap but is very nutritious (Kabahenda et al., 2011).

Fig. 3. Proportion of pregnant women that craved for meats in the last pregnancy that resulted in a live birth.

As has been reported in other studies, this study recognizes the fact that pregnant women crave for foods to meet different physiological and psychological needs. Table 2 shows women's cravings ranged from desires for foods with specific organoleptic properties (such as sour taste) to foods that are believed to influence pregnancy outcomes (such as 'mucilaginous vegetables to ease child delivery'). These cravings indicate the need for nutrition education to support women to make better food choices to quench their cravings. In order to guide practitioners that provide nutrition education to pregnant women, efforts have been made in this study to categorize craved foods based on their possible impacts on maternal and fetal health. As shown in **Table 2**, foods that were craved by pregnant women included in this study can be categorized in three broad categories as: (i) risky craving practices (x); (ii) potentially harmful practices ($\pm$); and (iii) practices that might improve dietary adequacy and pregnancy outcomes ($\checkmark$).

In general, the fact that about two-thirds of the women reported craving for items listed as commonly craved substances by key

informants from the study areas indicates that some women are likely to have embraced craving as a social norm. This may partly explain the trend of craving for cultural favorites, some of which are also categorized as *fluids*, *bland foods* and '*foods that ease childbirth*' (see **Table 2**). Addressing cravings for 'cultural favorites' has been suggested to potentially relieve stress. However, since most 'cultural favorites' identified in the current study were bland foods, craving for these foods can also be a physiological need to counteract complications such as nausea and vomiting (Nordin et al., 2004). The craving for dilute porridges (another cultural favorite) may also be a mere physiological need to quench the excessive pregnancy-induced thirst (Soma-Pillay et al., 2016). The current study also highlights a practice where women reported consuming some foods to 'ease childbirth' under the guise of cravings, which also indicates that craving may be driven by an interplay of innate mechanisms and cultural norms devised to protect oneself from ill health.

Table 2. Characterization of common food cravings and their potential health implications

<i>Food attribute</i>	<i>Participants descriptions of the foods they craved</i>	<i>Possible implications on health</i>
Potentially dangerous options	× <i>Raw food without sauce</i> × <i>Raw sweet potatoes</i> × <i>Raw cassava</i> × <i>Raw, sundried cassava chips or flour</i> × <i>Alcohol (local brews)</i> × <i>Dredges from locally brewed alcoholic beverages</i>	Potentially dangerous food products. Cassava products likely to be toxic. Less likely to contribute significantly to caloric and micronutrient intake.
Bitter or sour foods	± <i>Bujabala with doodo (amaranthus sp.)</i> ± <i>Foods with bitter tastes</i>	May displace more nutritious meals or relishes. No potential risk if consumed less frequently as part of a nutritionally adequate diverse diet.
Bland diets	± <i>Banana katogo [stew] without salt</i> ± <i>Bananas boiled without sauce</i> ± <i>Steamed cassava without sauce</i> ± <i>Food without cooking oil</i> ± <i>Food that is not fried</i>	
Fluids	± <i>Watery millet porridge</i> ± <i>Watery porridge (fermented)</i>	Unfermented porridge is nutrient-dilute when it is watery. May also replace more nutritious foods. Porridge fermented for 24 hours or more has high concentration of alcohol. Alcohol endangers fetal health.
Savory foods	± <i>Raw mango with salt</i> ± <i>Licking salt</i> ± <i>Salty foods</i> ± <i>Just put in salt</i> ± <i>More salt</i>	Possibly indicate unmet sodium needs since rural diets are plant-based with very little or no processed foods. Caution needed for those at risk of hypertension.
Special flavors	√ <i>Chapatti [flat bread]</i> √ <i>Roasted potatoes, cassava or bananas (gonja)</i> √ <i>Paani or Kabaragara [deep fried banana pancakes]</i> √ <i>Ghee in dodo</i>	More convenient foods in rural context. May relieve hunger and provide the caramelized starchy flavors craved.
Less frequently consumed foods	√ <i>Omubumbo [Matooke][¶] with meat</i> √ <i>Pork with cabbage and tomatoes</i> √ <i>Boiled mature maize (corn) on the cob</i> √ <i>Other food such as meat or fish [not usual diet]</i> √ <i>Matooke[¶] with groundnut sauce mixed in cabbage</i> √ <i>Groundnut sauce</i> √ <i>Liver</i> √ <i>Milk tea</i> √ <i>Meat</i> √ <i>Food with sauce[†]</i> √ <i>Rice with meat</i> √ <i>Rice with avocado</i> √ <i>Rice with groundnut sauce</i> √ <i>Cabbage</i> √ <i>Raw tomatoes</i> √ <i>Irish potatoes</i> √ <i>Roasted meat</i> ± <i>Fatty meat</i> ± <i>Good food</i> ± <i>Soda</i> ± <i>Modern food</i>	All foods listed here are okay if consumed as part of a diverse diet. Foods marked with ± need to be consumed with caution or less frequently especially among those at risk of excessive weight gain and those with a history of giving birth to larger-for-gestation age babies.
Cultural favorites	√ <i>Roasted beans stewed with bananas and served with steamed nswiga (solanum nigra) as side dish</i> √ <i>Katogo [stew] of bananas mixed with beans</i> √ <i>Doodo with akaro [millet meal]</i> √ <i>Omubumbo (Matooke)[¶] with groundnut sauce</i> √ <i>Groundnut sauce with smoked meat/mushrooms</i>	All foods listed here are okay if consumed as part of a diverse diet.

	√ <i>Paani</i> [<i>kabaragara</i> or deep-fried banana pancake]	
	√ <i>Nyamusiri</i> (<i>Corchorus sp</i>) and <i>akaro</i> [millet meal]	
Believed to ease childbirth	√ <i>Mucilaginous local sauces/soups</i> : - <i>Doodo</i> with <i>nyamusiri</i> (<i>Corchorus sp.</i>) - <i>Doodo</i> with <i>ebituruguma</i> (<i>Malva verticillate</i> or Chinese mallow) - <i>Eteke</i> (<i>Hibiscus sp.</i>) √ <i>Goats' legs</i>	These foods may improve nutriture if consumed as part of a diverse diet. The belief that they 'ease childbirth' needs investigation.

Notes: Italicized content indicates examples quotations of how women describe the food or its attributes.

× Risky practice; ± May be harmful when used frequently; √ Practice may improve dietary intake

† Main dishes in less-resourced households are pottages/stews; staples complemented with sauce/relish are special meals.

¶ Green vegetable bananas that have been peeled, steamed, and then mashed

§ Deep fried banana quick bread which is well known for its unique roasted/caramelized banana aroma

It is important to note that most foods classified as '*less frequently consumed foods*' are foods that are regularly consumed in better resourced households within the study area. Indeed, these foods comprise the main dishes of urban households, which depend on food purchases. However, since this study targeted resource-constrained rural women, it is possible that they had limited access to these foods because they could not afford them. Conversely, since the participants in the current study were from rural farming households, there is also the possibility of overreliance on household food production. For instance, rice is the most craved food in the *grains* food group; however, rice is readily available and commonly used as a staple food in urban areas, but since it is not locally produced, it is occasionally consumed in rural settings. This is in line with findings from other studies where pregnant women were documented to crave for 'scarce' or less frequently consumed foods (Demissie et al., 1998; Handiso, 2015; Placek et al., 2017). In this case, the anticipated pleasurable experiences associated with '*less frequently consumed foods*' can be equated to expected experiences among satiated women that crave for specific foods such as a specific brand of fast-food item or ice cream in developed countries (Orloff & Hormes, 2014).

The reported cravings for alcoholic products are major concerns since alcohol consumption during pregnant is associated with poor pregnancy outcomes. Notably, the alcohol products that women craved included *Tonto* (*banana juice fermented using sorghum*), maize-sorghum fermented drinks (*Mukomboti* or *Umqombothi*), and *Waragi* (hard liquor). *Waragi* has a high alcohol by volume (ABV) content averaging 40% (Otim et al., 2019) while the ABV of fermented local brews such as *Kwete* ranges from about 3% for fresh brews (fermented for about 24 hours) to about 15% when fermented for about 72 hours (Muyanja & Namugumya, 2009); which means that these brews have alcohol content of most distilled beers and thus are not appropriate for pregnant women. Even more worrying is the fact that some women craved for dredges from *Tonto* and *Kwete* (a fermented maize meal alcoholic drink) and yet these dredges often have more concentrated alcohol than the filtrate. Although the practice of craving hard liquor was reported by few women

in this study; pregnant women in other parts of the country were reported to use alcohol during pregnancy because it is 'culturally known' to 'cleanse the baby in the womb' (Agiresaasi et al., 2021). These reports of risky craving practices explained by unfounded beliefs call for interventions to regularly screen for and to educate pregnant women about the dangers of alcohol consumption during pregnancy as recommended (WHO, 2016).

3.6 Associations between cravings with anemia, stage of gestation, and maternal age

Overall, the occurrence of cravings was not associated with being diagnosed with anemia, stage of gestation, and maternal age. However, further analyses of cravings by food groups revealed that a significantly higher proportion of women in early pregnancy (≤ 20 wGA) or in maternal anabolic phase craved for fruit than those in late pregnancy (≥ 21 wGA) or fetal anabolic phase (30.0% vs. 14.8%; $X^2 = 6.699$; $p = .010$). The stage of gestation accounted for 8.5% of the variation in the likelihood of craving for fruit (OR = 0.463; 95%CI: 0.243, 0.882; $p = .017$). This is not surprising since fruits are commonly craved for their tangy flavor to counteract nausea experienced in early pregnancy.

Since cravings during pregnancy have been associated with cultural context and potential social expectations (Baum et al., 2020; Hook, 1978; Madziva & Chinouya, 2020), it was hypothesized that older women (25-43 years) were more likely to crave than younger women (15-24 years). Unexpectedly, there were no significant differences in the mean number of non-food or raw food items craved by younger and older women (mean = 1.57±0.91 vs 1.59±0.94; $p = .891$) and almost similar proportions of younger and older women craved for non-food items (40.4% vs. 39.6%; $p = .834$) and actual foods (76.8% vs. 76.1%; $p = .600$). Conversely, when compared with older women, a significantly higher but smaller proportion of younger women craved for raw sorghum flour (3.8% vs. 1.3%; $X^2 = 4.314$; $p = 0.038$). It is unclear whether the effect of maternal age on craving was confounded by parity. Notably, primigravida women craved a significantly higher number of non-food items (Mean = 1.84±1.20; 95%CI: 1.53, 2.14; $p = 0.015$) than women who had experienced other pregnancies (Mean = 1.52±0.83; 95%CI: 1.42,

1.62). In order to elucidate the influence of parity on cravings, there is need for cohort studies to improve understanding of dietary practices and craving patterns of women during different pregnancies.

The major limitation of the current study was the practice of women “not wanting to publicize their pregnancy until a bump started showing”. This limited the inclusion of women in the very early stages of pregnancy, when we expected them to begin craving. Hence, this study could not document the dietary practices and craving patterns in the first trimester. The other challenge was that much of the data collected in the current study relied on self-reports, which is likely to induce bias and result in over-reporting of desirable practices and under-reporting of less desirable practices. Hence, longitudinal studies are needed to improve our understanding of food craving patterns in women at different stages of pregnancy

CONCLUSION

Given the low dietary diversity and limited meal frequency documented in the current study, the dietary intakes of pregnant women in this context can be considered suboptimal to support normal pregnancies. The high incidence of cravings among women with low dietary diversity also suggest that poor dietary intake may foster risky craving practices such as amylophagia. Hence, ‘giving in’ to cravings for food may help improve pregnant women’s caloric and micronutrient intake, which can possibly improve pregnancy outcomes by supporting necessary gestational weight gain. This is especially important in contexts where pregnant women crave for nutrient-dense foods (such as meat, dairy products, fruit, vegetables, and eggs) that are consumed less frequently. The major foreseeable concern over craving foods in this context is the possibility of replacing nutrient-dense food options with low-calorie and possibly nutrient-dilute foods, such as starchy roots and tubers and dilute porridges. Hence, interventions are needed to improve pregnant women’s awareness of the appropriate food selection practices and the dangers associated with pica, use of alcoholic products, and other risky craving practices discussed.

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CONFLICT OF INTEREST

The author declares no potential conflict of interest from the institutions, persons or any other entities.

DATA AVAILABILITY

The data used to support the findings of this study are available upon reasonable request from the corresponding author.

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