Intrahousehold Power Dynamics, and the Willingness to Pay for Fortified Maize Flour and Biofortified Beans in Rwanda

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Abstract

This study investigates how intrahousehold power dynamics affect spouses' willingness to allocate resources and purchase relatively expensive fortified maize flour and biofortified beans in informal settlements in Rwanda. It also assesses how increased intrahousehold power dynamics in relation to income influence mothers' and fathers' willingness to purchase the (bio)fortified products for their under-five aged children. Furthermore, it seeks to understand the purchase behaviour of pregnant women and lactating mothers, majority of whom are presently consuming conventional unfortified maize flour and beans. It does this by assessing their willingness to pay for the (bio)fortified versions of these products, and how increased monetary bargaining power relative to their spouses and access to decent or living wages influence their inclination to pay for such products. In general, we find evidence that intrahousehold power dynamics lead to engendered purchase outcomes. Women with higher economic resources and are food purchase decision makers exert more bargaining power and willingness to pay for the (bio)fortified food. An exception is pregnant women and lactating mothers who revealed significant unwillingness to pay except those who earn decent income. However, men reveal a disconnection between nutrition and masculinity as they are less willing to pay for the (bio)fortified products, even when they have higher economic resources than their spouses, or when they are sole food purchase decision makers. In contrast to women, men tend to allocate monetary resources away from their under-five aged children, which result from discriminatory gender norms that are in disconnection with improved household nutritional outcomes. We advocate for community-level interventions that incorporate men in nutrition intervention programmes to help in reshaping or eliminating patriarch and discriminating gender norms, and allowing the evolution of better societal norms that can propel household nutrition security and outcomes.

1. Introduction

Globally and particularly in Africa, malnutrition is a perennial problem affecting mostly children, and adolescent girls and women. Malnutrition accounts for about half of all deaths in children under 5 years in the world (UNICEF, 2023a) and maternal and child malnutrition remain a perennial health challenge in Africa (Chege et al., 2019). According to a 2023 UNICEF report, about 43%, 27%, and 28% of children under 5 in Africa were affected by stunting, wasting, and being overweight respectively (UNICEF, 2023). Adolescent girls and women bear the burden of undernutrition and anaemia with over 68% and 60% affected by underweight and anaemia respectively in South Asia and Sub-Saharan Africa. The gender gap and asymmetries in food insecurity is further exacerbated by the disproportionate access by men and women to productive resources such as education, finance, land, technology,

labour, social networks, extension services, skills and training, as well as discriminatory social and cultural norms which limits women's access to safe and nutritious food, decision making, and employment opportunities (World Bank et al., 2009; UNICEF, 2023b). Expressions of power and control over productive resources are part of how food is produced, processed, marketed, accessed, and consumed in the food supply chain and food environment. Therefore, exclusion of certain groups especially women from participation in the control and management of productive resources within agri-food systems greatly affects the nutrition and health outcomes at both the entry and exit points (Barnes and Burchard, 2013).

The triple burden of malnutrition - stunting, wasting, and being overweight is a significant public health problem in Rwanda, as in many other developing countries. According to the Global Hunger Index (GHI), Rwanda is ranked 96th out of 125 countries, with a GHI score of 25.4 indicating a "serious" severity in the levels of hunger (GHI, 2023). In Rwanda, undernourishment and child stunting remains high at 31.6% (4.3 million people) and 33.1% respectively. According to estimates of the Global Alliance for Food Security (GAFS, 2023), the prevalence of adult overweight and obesity is 25.10%, while in 2020, the share of the population who cannot afford a healthy diet is 83.60%. In 2019, in terms of micronutrient coverage, the prevalence of anaemia in pregnant women (aged 15-49) stood at 23.50%, while the prevalence of iron-folic acid supplementation during pregnancy stood at 80.60%. Thus, the production and consumption of food that are fortified with relevant micronutrient supplements such are iron and vitamins could be leveraged as an effective public health and agricultural policy intervention to build sustainable, equitable, inclusive food systems and in achieving the Sustainable Development Goals (SDGs) of good health and wellbeing (SDG3), zero hunger, (SGD2), and gender equality and women empowerment (SGD5) in Rwanda.

In this paper, we estimate consumers' perception and expenditure decisions of a healthy and nutritious food by evaluating their willingness to pay (WTP) for a government-recommended fortified maize flour and biofortified beans using primary data collected in urban and rural informal settlement areas in Rwanda. We deploy the Becker-DeGroot-Marshak (Becker et al., 1964) experimental auction mechanism to elicit the willingness to pay for the (bio)fortified[1] food products. Our study makes a variety of contributions to the growing body of literature on food system transformation and WTP for nutritious and healthy foods. Firstly, a growing body of extant literature has analysed the willingness to pay for healthy, quality, and nutritious food (De Groote et al., 2011; Birol et al., 2014; Oparinde et al., 2015; Oparinde et al., 2016). However, few have focused on WTP particularly by pregnant women, lactating women, and women of childbearing age in both urban and rural settlements. A focus on this group is important given that these groups usually make food purchase decisions, and are at a higher risk of undernutrition, micronutrient deficiencies, and anaemia (UNICEF, 2023b). It is thus imperative to assess their WTP and how they value nutritious food, which can provide in-depth insight into the acceptability.

Secondly, although the literature on WTP for safe and nutritious food in Africa continues to grow, relatively little research has been carried out from a power relation lens within the household. We embrace a more holistic approach by examining how intra-household bargaining power dynamics and decision making as well as access to productive resources impact on the ability to pay for nutritious food in the food environment. Moreover, there is a consensus that women play a critical role in household food and nutrition security (Tibesigwa and Visser, 2016) and their access to productive resources and empowerment improves household nutrition and health outcomes (Njuki et al; 2022; Quisumbing et al., 2023).

[1] In this study, we refer to the fortified maize flour and biofortified beans as (bio)fortified food products.

However, evidence shows that women have limited access to these resources (Quisumbing and Doss, 2021; FAO, 2023) due to persisting gender inequities in the governance of agri-food systems. In addition, gender norms that promote a dissonance between nutrition and patriarchy roles, might prevent the allocating resources to improve household nutrition and health outcomes leading to pareto inefficient household nutrition outcomes. Thus, distinct from other WTP studies, we assess if and how bargaining power in relation to education, income and employment status affect their willingness to pay for the micronutrient enhance products and their allocation of resources to the products through a gender lens. Thirdly, distinct from other studies, we also consider how entrenched discriminating local gender norms that support unequal household food allocation and consumption and gender violence engender the willingness to purchase the biofortified food products among spouses.

Fourthly, we use a unique experimental data collected in 5 rural and urban informal settlements in Rwanda to provide new evidence on the impact of interventions in the forms of pricing strategies and nutrition information to consumers. The extant literature shows that the provision of nutrition information are important drivers of dietary behaviour and WTP for nutritious foods (Rubyogo et al., 2019; Chege et al., 2019; Chege et al., 2021). However, relatively little research has been carried out to assess the impact of interventions in the forms of pricing strategies and nutrition information using experiments and experimental estimation methods (c.f. Chege et al., 2021). Finally, our focus on maize and beans[2] is unique as they constitute staple foods highly consumed by households in Rwanda and vital for household food and nutrition security. Given that the food system might be fraught with power relations in food retail markets and the food environment, we provide novel insights and evidence on intra-household bargaining power and the contextual dynamics in Rwanda.

The rest of the study is organized as follows. Section 2 reviews the evidence on consumers' willingness to pay (WTP) for healthier food options. Section 3 presents the conceptual framework of the study depicting the interactions of the different domains in the food environment. The data and methodology are presented in Section 4, while section 5 presents the results and discussion. The final section concludes with some policy implications.

2.0. Literature Review

The concept of WTP for healthy diets has gained increasing attention in sub-Saharan Africa as countries in the region grapple with the double burden of malnutrition. This review examines the empirical evidence on consumers' WTP for healthier food options in sub-Saharan Africa. A key factor influencing WTP for healthy foods is consumer awareness and attitudes regarding nutrition and health. Several studies have examined this in the sub-Saharan African context. In Ghana, Badu-Gyan & Owusu (2017) found that consumer awareness of the health benefits of functional foods was positively associated with WTP a premium for such products. Consumers who are knowledgeable about Moringa products are more willing to pay over 50% higher prices for Moringa bread. Similarly, in Kenya, Kimenju and De Groote (2008) reported that consumers who were more knowledgeable about the nutritional benefits of biofortified maize expressed higher WTP. However, awareness alone does not always translate to higher WTP. A study in Uganda by De Steur et al. (2012) on biofortified sweet potato found that while most consumers recognized its nutritional benefits,

[2] Rwandans have the highest per capita bean consumption in the world estimated at 164 grams (g)/day. On average, beans provide 32% of calorie intake in a Rwandan diet and as high as 65% of protein intake, whereas animal-source foods provide only 4% of protein intake. About 97% rural households in Rwanda are bean producers with the majority of rural households' bean consumption coming from own production (79–88%) and the remainder purchased from the market (Oparinde et al., 2016).

this did not significantly impact their WTP. The authors suggested that taste and other sensory attributes may play a more important role in driving WTP for some consumers. In Rwanda specifically, limited research has been conducted on consumer awareness and attitudes toward healthy diets. Reports from the National Institute of Statistics Rwanada (NISR, 2022) found relatively low levels of nutrition knowledge among rural households, which could potentially impact WTP for nutrient-dense foods.

Numerous studies have examined how socioeconomic factors influence WTP for healthier food options in sub-Saharan Africa (Owusu, 2012). Income level is consistently found to be a significant determinant, with higher-income consumers generally willing to pay more for nutritious foods (Badu-Gyan and Owusu, 2017; Oparinde et al., 2016). Education level also tends to be positively associated with WTP, as more educated consumers may have greater nutrition knowledge and place higher value on health (De Groote et al., 2011). Urban-rural differences have been observed in several countries. Murekezi et al. (2015) examined WTP for quality protein maize in Rwanda and found that income, education, and urban residence were positively associated with WTP than their rural counterparts. The authors attributed this to greater nutrition awareness and higher incomes in urban areas. However, Oparinde et al. (2016) found that in some cases, rural consumers in Nigeria were willing to pay more for biofortified cassava, possibly due to greater familiarity with the crop. Gender differences in WTP have also been reported, though results are mixed. Some studies find that women express higher WTP for nutritious foods, potentially due to their role in household food purchasing and preparation (Badu-Gyan and Owusu, 2017; Owusu, 2012). However, others report no significant gender differences (De Groote et al., 2011).

The specific attributes of healthier food products can significantly impact consumers' WTP. Taste and sensory characteristics are consistently found to be important drivers of WTP across sub-Saharan Africa. For example, Gichuyia et al. (2024) found that Kenyan consumers were willing to pay a premium of KES 245 (approximately 2.1 USD) per kilogram for pork that had undergone thorough veterinary inspection. Additionally, they were willing to pay KES 164 (approximately 1.4 USD) more per kilogram for pork from butcheries with higher hygiene standards. Similarly, Meenakshi et al. (2012) found that taste was the most important factor influencing WTP for biofortified cassava in Nigeria. Also, appearance and colour can also play a role, particularly for biofortified crops. In Zambia, Chowdhury et al. (2011) reported that consumers were willing to pay less for orange maize compared to white maize due to unfamiliarity with the colour, despite its higher vitamin A content. However, nutrition education interventions were able to increase WTP for the orange variety. In addition, convenience and ease of preparation have been found to influence WTP for some products. In Kenya, Kimenju and De Groote (2008) reported that consumers were willing to pay more for fortified maize meal that could be cooked more quickly than traditional varieties. For packaged foods, factors like brand reputation and packaging quality can impact WTP. A study in Ghana (Badu-Gyan and Owusu, 2017) found that consumers were willing to pay more than 50% for functional foods from well-known brands, perceiving them as higher quality. Similarly, Owusu (2012) found that beyond socioeconomic characteristics and consumer perceptions, product attributes significantly influence consumer preferences for organic watermelon and lettuce. The study estimated that consumers are willing to pay an average premium of GH¢0.5554 (US$0.4575) per kilogram for organic watermelon and GH¢1.2579 (US$1.0361) per kilogram for organic lettuce. Moreover, in Rwanda, limited research has examined how specific product attributes influence WTP for healthy foods. One study by Murekezi et al. (2015) on quality protein maize found that consumers valued traits like yield and disease resistance in addition to nutritional benefits. Furthermore, findings by

Alphonce and Alfnes (2012) in Tanzania indicate that, on average, consumers in Tanzania are willing to pay a premium for tomatoes that are inspected and organically produced.

Price sensitivity is a critical factor influencing WTP for healthier food options, particularly given the income constraints faced by many consumers in sub-Saharan Africa. Several studies have examined price elasticity of demand for nutritious foods in the region. In Uganda, Meenakshi et al. (2012) found that demand for biofortified orange sweet potato was highly price elastic, with a 10% price increase leading to a 20% reduction in demand. This suggests that even small price premiums could significantly reduce uptake of more nutritious varieties. However, price sensitivity can vary based on the specific product and context. A study in Nigeria by Oparinde et al. (2016) found that demand for biofortified cassava was relatively inelastic, with consumers willing to pay a premium of up to 50% for the nutritionally enhanced variety. Moreover, income level plays a key role in price sensitivity. Studies (Badu-Gyan and Owusu, 2017; Owusu, 2012) reported that higher-income consumers in Ghana were less price sensitive when it came to moringa and organic lettuce poducts respectively, while lower-income groups were much more responsive to price changes. In Rwanda, there is limited empirical evidence on price sensitivity for healthy food options. Murekezi et al. (2015) found that farmers were willing to pay a premium of about 20% for quality protein maize seed, but it's unclear how this translates to consumer WTP.

The provision of nutrition information and product labelling can significantly impact consumers' WTP for healthier foods. Several studies in sub-Saharan Africa have examined how different types of information influence WTP. In Kenya, Kimenju and De Groote (2008) found that providing information about the nutritional benefits of fortified maize increased consumers' WTP by 24%. Similarly, in Uganda, De Steur et al. (2012) reported that nutrition information increased WTP for biofortified sweet potato, particularly among more educated consumers. The format of information provision matters. A study in Nigeria by Oparinde et al. (2016) compared different methods of communicating the benefits of biofortified cassava. They found that radio messaging was more effective than community leaders in increasing WTP, possibly due to greater trust in mass media. Product labelling can also influence WTP, though its impact may vary. In Ghana, Badu-Gyan and Owusu (2017) and Owusu (2012) found that nutrition labels increased WTP for functional foods (moringa) among more educated consumers. However, Chowdhury et al. (2011) reported that labelling had limited impact on WTP for biofortified maize in Zambia, suggesting that other factors like sensory attributes may be more important for some products. In Rwanda, there is a lack of empirical research on how information and labelling impact WTP for healthy foods. Given the government's focus on improving nutrition, understanding how to effectively communicate the benefits of nutritious options to consumers could be valuable for policymakers and food producers.

Access to markets and availability of healthy food options can significantly influence consumers' WTP. Several studies have examined how market factors shape WTP in sub-Saharan Africa. The authors suggested that greater exposure to diverse food products in these areas may increase awareness and demand for healthier options. Seasonality and supply chain issues can impact availability and thus WTP. Studies in Tanzania by Alphonce and Alfnes (2012) show that consumers have strong preference for tomatoes produced in the country and do not discount those from regions known for poor agricultural practices. However, they significantly discount tomatoes imported from South Africa. A study in Nigeria by Oparinde et al. (2016) found that WTP for biofortified cassava varied seasonally, with consumers willing to pay more during periods of lower overall cassava availability. However, the type of market outlet can also play a role. In Kenya, Kimenju and De Groote

(2008) reported that consumers purchasing from supermarkets expressed higher WTP for fortified maize compared to those buying from traditional markets. This may be due to differences in product quality, packaging, or consumer demographics across outlet types. In Rwanda, market access varies significantly between urban and rural areas. The National Institute of Statistics Rwanda (NISR, 2022) found that rural households had more limited access to diverse food groups compared to urban households, which could impact WTP for healthier options.

Various policy interventions have been implemented or proposed to increase WTP and consumption of healthy foods in sub-Saharan Africa. Several studies have examined the potential impact of such interventions. Subsidies for nutritious foods have shown promise in some contexts. In Uganda, Gilligan et al. (2014) found that subsidies for biofortified orange sweet potato significantly increased adoption and consumption among smallholder farmers. However, the long-term sustainability of such subsidy programs remains a concern. Also, Nutrition education interventions have been found to increase WTP in several studies. In Zambia, Chowdhury et al. (2011) reported that nutrition education campaigns increased consumers' WTP for biofortified orange maize. Similarly, in Nigeria, Oparinde et al. (2016) found that nutrition information delivered via radio increased WTP for biofortified cassava. Regulations on food labelling and marketing could potentially impact WTP, though evidence from sub-Saharan Africa is limited. In South Africa, which has more advanced regulations than many countries in the region, Koen et al. (2016) found that mandatory nutrition labelling increased consumer awareness but had mixed effects on purchasing behaviour. The Rwandan government has implemented several nutrition-focused policies, including biofortification programs and school feeding initiatives (NISR, 2022). However, there is limited empirical evidence on how these policies have impacted consumer WTP for healthy foods. More research is needed to evaluate the effectiveness of different policy approaches in the Rwandan context.

This review has synthesized the empirical evidence on willingness-to-pay for healthy diets in sub-Saharan Africa, with a focus on Rwanda where possible. The literature reveals that WTP is influenced by a complex interplay of factors, including consumer awareness, socioeconomic characteristics, product attributes, price sensitivity, information provision, market access, and policy interventions. While a growing body of research exists for several countries in the region, there remains a significant gap in empirical studies specifically examining WTP for healthy foods in Rwanda. Given Rwanda's focus on improving nutrition and food security, more research is needed to understand the factors shaping consumer demand for nutritious options in the country. This could inform targeted interventions and policies to promote healthier diets and address the double burden of malnutrition facing Rwanda and the broader sub-Saharan African region.

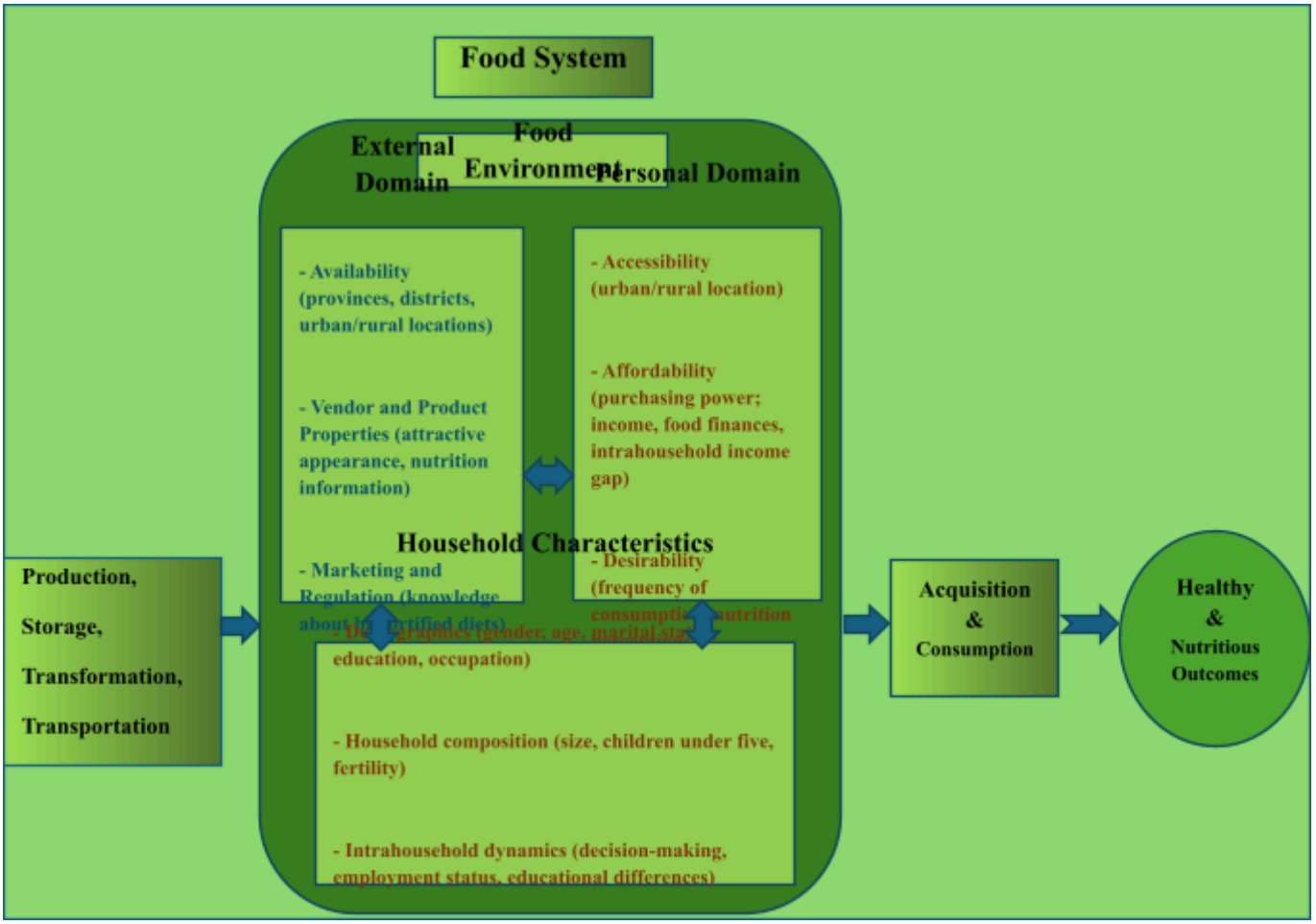
3.0. Conceptual Framework: A Food Systems Approach

The adapted framework for studying willingness to pay for biofortified foods in Rwanda is based on Turner et al. (2018). It demonstrates a high degree of interconnectedness between person, household and external factors affecting healthy diets. This interlink reflects the complex nature of food environments and decision-making processes related to food acquisition and consumption. The framework's core strength lies in its recognition of the continuous interplay between external and personal domains. As Herforth and Ahmed (2015) note, food environments are not static entities, but dynamic systems shaped by both structural factors and individual experiences. For instance, the availability of biofortified foods (an

external dimension) directly influences an individual's accessibility to those foods (a personal dimension).

The distinction between availability and accessibility is particularly important in the context of biofortified foods in Rwanda. While availability refers to the presence of biofortified foods in different provinces or districts, accessibility considers individual-level factors such as distance to markets or transportation opportunities. This nuance is crucial in sub-Saharan Africa, where food may be available in markets but not accessible to all due to transportation or time constraints (Turner et al., 2018). Moreover, the external characteristics of biofortified foods, such as attractive appearance or packaging and availability of nutrition information, influence how desirable these foods are perceived to be by consumers. This interaction is particularly relevant in the context of biofortified foods, where consumer acceptance and desirability can significantly impact willingness to pay (Birol et al., 2015). Likewise, the role of knowledge and information about biofortified diets (an external factor) significantly shapes food desirability (a personal factor). De Groote et al. (2018) discuss how information and awareness campaigns can influence consumer preferences and willingness to pay for biofortified foods.

Figure 1: The Nexus between External, Personal and Household determinants of Healthy Diets



Source: Authors' illustration, adapted from Turner et al., (2018)

The framework recognizes that affordability is not just about market prices but is relative to individual and household characteristics. Factors such as monthly income, intrahousehold income gap, and food finances all contribute to how affordable biofortified foods are perceived to be. This aligns with findings from studies on willingness to pay for biofortified crops in various African contexts (Oparinde et al., 2016c). Furthermore, the inclusion of intrahousehold dynamics in the framework is particularly important. Factors such as decision-making processes, employment status differences, and educational disparities within households can significantly influence food acquisition choices. This is especially relevant in the context of biofortified foods, where nutrition knowledge and household power dynamics can play crucial roles (Gillespie and van den Bold, 2017). While not explicitly a dimension in the framework, the socio-cultural context permeates both external and personal domains. Cultural norms and values influence food choices and how individuals interact with their food environment. This is especially important in diverse settings like Rwanda, where food cultures may be rapidly changing due to urbanization and exposure to global food trends (Ruel et al., 2017).

The interconnectedness highlighted in this framework has significant policy implications for promoting biofortified foods in Rwanda. It suggests that interventions targeting only one aspect of the food environment may have limited effectiveness. For example, improving the availability of biofortified foods without addressing accessibility, affordability, or desirability may not lead to desired changes in consumption patterns (Hawkes et al., 2020). This adapted framework provides a holistic and interconnected view of the factors influencing willingness to pay for biofortified foods in Rwanda. By emphasizing the dynamic interactions between external and personal domains, as well as individual and household characteristics, it offers a nuanced understanding of how various factors collectively shape food acquisition and consumption behaviours. This interconnected approach is essential for developing comprehensive strategies to improve nutrition outcomes through the promotion of biofortified foods in Rwanda and similar sub-Saharan African country contexts.

4.0. Methodology

This study investigates consumers' perception and valuation of the healthy and nutritious fortified maize flour and biofortified beans by evaluating their willingness them at the household level.

4.1. Experimental Design

To elicit the willingness to pay, this study relies on the Becker-DeGroot-Marshak (BDM) experimental auction mechanism (Becker et al., 1964) to test the willingness and attitude of consumers at the household level to buy the (bio)fortified food product in a non-hypothetical setting. To mimic closely a real-life choice process and buying experience in the market, the experiment was a non-hypothetical experimental auction where real money would be used to bid for and buy the actual products. The BDM approach was chosen as it is easy to implement, incentive compatible as it gives participants incentives to undertake bids truthfully, thereby revealing their true willingness to pay (Lusk et al., 2004).

In implementing the BDM approach, randomly selected participants would be asked to bid for the biofortified and conventional maize products at a price comparable to the market price that would be drawn randomly from a set of possible prices which would be predefined by the researcher anchoring the bidding process. The participant was then able to buy the

product at the bided price if the bid submitted is equal or greater than the researcher's random selling price. However, the participant loses the right to buy the product when the bid of the participant is less than the market price drawn by the researcher. Thus, the method discourages overbidding or underbidding their WTP and helps participants reveal their true WTP. This is because underbidding makes them to lose a valued product while overbidding makes them pay more than the worth of the product. The participants do not bid against each other, and choice experiment is conducted with each participant at the household level, which prevents their bids from being affiliated. More specific steps in the experimental auction are provided below in the case of beans, which is also applicable in the case of the maize flour products. While our interest is on only the biofortified beans, we also presented the conventional food products to them as many of them have only heard about biofortified beans but cannot distinguish the two. The steps are presented in Figure 2 below.

Figure 2: The Experimental Auction Approach using the BDM Mechanism

Source: Authors' illustrations

4.2. Potential Concerns

While the BMD method is easy to implement, however, in contrast to other auction methods such as the nth price and Vickrey auctions, it can lead to unintentional bias valuation by uninformed participants who mismatch the bidding mechanism with the conventional bidding process, (Skuza et al., 2015). However, the BMD allows for true valuation compared to the Vickery method which can lead to irrelevant bids and overbidding (Lusk, Feldcald and Schroeder, 2004). Thus, to avoid valuation bias, the participants were randomly selected in informal settlements using a systemic random sampling approach. In addition, we engage the participant in "cheap talk", educating them about the process and the importance of revealing their true willingness to pay.

4.3. Data and Study Area

Our sample will focus on men and women including those who have children, as well as pregnant and lactating women living in informal settlements in the five provinces in Rwanda. this age bracket main agents of nutrition in the household. Kigali, the capital of Rwanda has a high level of informal settlement. Moreso, Kigali city is the economic center of the country and boost of about 63% of its settlement are unplanned, thus making it a major focus province in the study. However, for completeness, other informal settlements areas in other provinces are also focused on. Thus, data collection was from all the 5 administrative districts in Rwanda. These include Amajyaruguru (northern province), Amajyepfo (southern province), Iburasirazuba (eastern province), Iburengerazuba (western province) and Umujyi wa Kigali (Kigali). In Rwanda, each province are divided in districts and and our data on the five provinces span over 9 disticts. These are Bugesera, Gasabo, Gicumbi, Kamonyi, Kicukiro, Nyarugenge, Nyaruguru, Rulindo and Rwamagana.

Participation criteria in the auction experiment is that participants are aged 15 and above, to ensure that women of childbearing age are included among the participants. In addition, data was also collected from men who are also be in the same age bracket with the women. Based on this, in each province, the selection of participants were randomly drawn with participation in the experiment being voluntary. Experiment participants are household food decision-makers who are usually heads of households or their spouses, with the participants would bid for the biofortified and conventional maize. The summary statistics of the experimental participants are provided in Table 1.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WTP (bids) in Rwandan Franc	363	1248.347	461.932	500	3000
Gender					
a. Female	363	.543	.499	0	1
b. Male	363	.457	.499	0	1
Age					
b. 20-29	363	.22	.415	0	1
c. 30-39	363	.424	.495	0	1
d. 40-49	363	.256	.437	0	1
e. 50-64	363	.074	.263	0	1
f. Greater than 65	363	.025	.156	0	1
Marriage Age	.	.	.	.	.
a. Less than 5 years	362	.249	.433	0	1
b. 5 to 10 years	362	.296	.457	0	1
c. 11 to 16 years	362	.276	.448	0	1
d. 17 to 22 years	362	.102	.303	0	1
e. Greater than 22 years	362	.077	.268	0	1
Education					
a. No education	363	.036	.186	0	1
b. Primary education	363	.388	.488	0	1
c. Vocational education	363	.074	.263	0	1
d. Secondary education	363	.281	.45	0	1
e. Tertiary education	363	.22	.415	0	1
Occupation	.	.	.	.	.
a. Civil or public servant	363	.074	.263	0	1
b. Farm Activities	363	.336	.473	0	1

c. Other salary earner (private)	363	.185	.388	0	1
d. Retailer or market woman/man	363	.264	.442	0	1
e. Artisan	363	.047	.212	0	1
f. Unemployed	363	.094	.292	0	1
Spouse Education					
a. No education	361	.047	.212	0	1
b. Primary education	361	.382	.487	0	1
c. Vocational education	361	.078	.268	0	1
d. Secondary education	361	.271	.445	0	1
e. Tertiary education	361	.222	.416	0	1
Spouse Occupation					
a. Farmer	362	.224	.417	0	1
b. Other agricultural activities	362	.099	.3	0	1
c. Civil or public servant	362	.102	.303	0	1
D. Other salary earner (private)	362	.18	.384	0	1
e. Retailer or market woman/man	362	.169	.375	0	1
F. Artisan	362	.077	.268	0	1
g. Unemployed	362	.122	.327	0	1
h. Others	362	.028	.164	0	1
Household Characteristics					
Household Size	358	4.623	1.667	1	9
Children Under-five years	352	.986	.726	0	5
Number of Children	347	2.539	1.634	0	8
Frequency of Consumption					
a. Always (every day)	361	.44	.497	0	1
b. Often (3 to 4 days per week)	361	.479	.5	0	1
c. Sometimes (1 to 2 days per week)	361	.069	.254	0	1
d. Rarely (about once a month)	361	.011	.105	0	1
Products' Attributes					
Attractive Appearance or Package	363	.174	.379	0	1
Availability of Nutrition Information	363	.433	.496	0	1
Perception and Consciousness about Nutrition					
Nutrition Health Information Cognition	361	.983	.128	0	1
Nutrition Deficiency Consciousness	362	.608	.489	0	1
Information	.	.	.	.	.
a. Yes	361	.72	.45	0	1
b. No	361	.28	.45	0	1
Household Barriers					
Unequal Food Quality	358	1.042	.201	1	2
Emotional Violence					
0	363	.986	.117	0	1
1	363	.014	.117	0	1
Preganant/Lactating					
a. Pregnant	360	.258	.438	0	1
b. Lactating	360	.133	.34	0	1
c. None of the above	360	.608	.489	0	1
Income and Finances					
Monthly Income	356	.174	.351	0	4.6
Spouse Monthly Income	344	.151	.303	0	5

Intrahousehold Income Gap (Million Rwanda Franc)	343	.021	.290	-1	4.45
a Husband Finances	361	.474	.5	0	1
b Wife Finances	361	.338	.474	0	1
c Husband and Wife Finances	361	.568	.496	0	1
Intrahousehold Education Gap	361	.219	.414	0	1
Intrahousehold Employment					
Employed Respondent and Unemployed Spouse	363	.11	.314	0	1
Employed Respondent and Spouse	363	.793	.405	0	1
Food Purchases Decision Makers					
a. Respondent	363	.353	.478	0	1
b. Spouse	363	.168	.374	0	1
c. Respondent and Spouse	363	.438	.497	0	1
Province					
Amajyaruguru (North)	362	.116	.321	0	1
Amajyepfo (South)	362	.133	.34	0	1
Iburasirazuba (East)	362	.177	.382	0	1
Iburengerazuba (West)	362	.006	.074	0	1
Umujyi wa Kigali (Kigali)	362	.569	.496	0	1
District					
Bugesera	362	.116	.321	0	1
Gasabo	362	.329	.47	0	1
Gicumbi	362	.028	.164	0	1
Kamonyi	362	.135	.343	0	1
Kicukiro	362	.13	.337	0	1
Nyarugenge	362	.105	.307	0	1
Nyaruguru	362	.003	.053	0	1
Rulindo	362	.086	.28	0	1
Rwamagana	362	.069	.254	0	1
Products					
a. Fortified maize	363	.493	.501	0	1
b. Biofortified beans	363	.507	.501	0	1
Location					
a. Urban	362	.638	.481	0	1
b. Rural	362	.362	.481	0	1

4.4. Model Specification

The traditional willingness to pay literature have identified several categories of variables that would affect attitude and willingness to pay for the products by consumers (Grote, Chege). These are (1) demographic variables (age, gender, number of children in the household, household size, household head; marital status, number of children aged under 5 years); (2) socioeconomic characteristics (education level, income of household head/purchase decisionmaker); (3) cognitive factors such as respondents' perceived improvement in overall nutritional status and health, and consumers' cognition indicating if they are worried about nutrition deficiency; (4) product attributes. Based on this, we begin with a baseline model which is specified as follows.

$$WTP_{ip} = \beta_0 + \varphi RespondentCharacteristics + SpouseCharacteristics + HouseholdCharacteristics + \beta_1$$

(1)

Where subscripts *i, p, d, a* and *l* are subscripts for the individual participant, products considered (fortified maize flour and biofortified beans), district and administrative province and the locality of the participants (urban or rural area), respectively. WTP_{idpl} is the depenedent variable, which is the monetary bids for the fortified maize flour (fortified) and beans (biofortified), indicating the maximum price that they are willing to pay for the product, in Rwandan Franc. $RespondentCharacteristics$ is the vector of individual characteristics that affect the participants' WTP which includes the gender, age, number of married years, education, occupation, monthly income. φ is the vector of their associated parameters. Furthermore, $SpouseCharacteristics$ is the vector of characteristics of the spouse that might affect the participants' WTP, and these includes spouse education, spouse occupation, spouse monthly income; while is the vector of their associated parameters. $HouseholdCharacteristics$ is the vector of participant's household characteristics which include household size, number of under-five year children, number of children of each participant, the latter which is used as a proxy of fertility which is included in the analysis based on the premise that higher level of birth further compromise nutritious intakes of low-income households. is the vector of their associated parameters of the household characteristics. Furthermore, a variable capturing the number of under-five children in the household is to provide insights on how the presence and size of under-five children influence mothers and fathers' willingness to allocate resources to the (bio)fortified food products. Rwanda has a prevalence of malnourished and stunted under-five children with stunting remain high at 33% in 2020s, falling from 38% in 2015 due to major policy interventions. Thus, the inclusion of this category of young children would enable the assessment of parents' inclination to pay for more nutritious food when there is a presence of them in the household.

In relation to the other variables, $PackagingAttributes_i$ denotes one of the products' attributes in relation to whether or not it has a great appearance, packaging. This variable assumes a value of one if the products' packaging or appearance stimulate their willingness to pay for the (bio)fortified food products, zero otherwise. This was included as many of the conventional food products are unpacked in the markets and sold in small quantities from large bowls, and the packaging and appearance of the (bio)fortified products might stimulate willingness to buy them. In addition, $NutritionInformation_i$ is another product attribute which is given a value of one if the availability of nutrition information on the product presented to them stimulate them to be willing to pay for the (bio)fortified food products, zero otherwise.

Two cognitive factors or participant's perception about nutrition or nutritional status are also included in the specified model due to the role of cognition and phycological disposition in

purchase behaviour. The first variable here is include $NutritionConciousness_i$ which assess if the experiment participants value nutrition information and use such to make decision. This variable takes a value of one for participants that perceive nutrition information as important to make food purchase decisions, zero otherwise. The second which is $NutritionDeficiencyConciousness$ measures the consumers' nutrition cognition in relation to if they are worried about nutrition deficiency, such that the variable assumes the value of one if they are worried, zero otherwise. Furthermore, α_p, α_d, α_a, and α_l are fixed effects at the product, district, province and locality levels, respectively, the latter three control for unobserved household and location effects. Finally, ε_{ip} is the error term.

4.4.1. Intrahousehold Power Dynamics

Intrahousehold factors are important in determining WTP since women are at the forefront of food purchase decisions and food preparations, while men usually dominate more expensive purchase decisions. The role of power dynamics within the household are thus important predictions of their willingness to pay. In relation to power dynamics, the existing literature have shown that higher income, employment, education and decision-making power usually are proxy for or measures of intrahousehold bargaining power which might influence their allocation of resources to ensure or improve household welfare (Maitra and Ray, 2005: Doss, 2013; Moeeni, 2021; Sariyev et al., 2021). Thus, this study also examines four domain of power relations in the household to understand men and women's willingness to allocate monetary resources to the more expensive (bio)fortified food products. The four domains are income, employment, education and food purchase decision making. In addition, in Rwanda, like many other African countries, the implications of entrenched gender norms that favour unequal food consumption in the household which disproportionally favour men over women and children, as well as emotional and psychological violence usually extended to partners arising from monetary or food-related problems are also examined. Based on the preceding discussion, our main model of interest is thus specified as follows.

$$WTP_{ip} = \beta_0 + \varphi RespondentCharacteristics ++ HouseholdCharacteristics + \beta_1 FreqConsumption_i + \beta_2 P \quad (2)$$

In equation (2), all variables are as earlier defined. However, spouse characteristics are now omitted but are instead used in the intrahousehold variables. In equation (2), $UnequalFoodQuality_i$ and $EmotionalVoilence_i$ capture household barriers and denote a situation of unequal food quality consumption and experience of emotional and psychological violence by the participants respectively. The former assumes the value of one in the existence inequality in food quality consumption in the household, zero otherwise. The latter assumes a value of one if the participant reported experience emotional and psychological violence from the spouse due to food-related problems. Income bargaining powers of the participants are measured by $IntrahouseholdIncomeGap$ which is the difference between the participants and their spouses' monthly income; $IntrahouseholdEduGap_i$ is a measure

of the educational powers of the participants which assumes the value of one if the participant's educational level is higher that his/her spouse, zero otherwise.

Next, are the intrahousehold employment status with $IntrahouseholdSameEmpStatus_i$ assuming a value of one when the respondent is employed but the spouse is not, while $IntrahouseholdSameEmployStatus_i$ assumes a value of one when both the respondent and spouse are employed, zero otherwise. Lastly, $IntrahouseholdFoodPurchaseDecision_i$ denotes a set of dummy variables which captures the individuals who make food purchase decisions in the households, while is the associated parameters. We differentiate between the unitary (individual spouses) and collective (both spouses) decision makers. The unitary dummy variables capture situations when the participant or the spouse is the sole decision maker. In relation to the former, the dummy variables assume the value of one when the respondent is the sole food decision maker, zero others. In the case of the latter, it takes the value of one when the spouse of the respondent is the sole food decision maker, zero otherwise. However, the collective decision maker dummy variable assumes the value of one when both the respondent and spouse are both joint decision makers, zero otherwise.

4.5. Estimation Method

Given that bids and prices cannot be negative, thus our dependent variable is monetary value that the bidders (respondents) are willing to pay to purchase the (bio)fortified food products. Such monetary values measured in Rwandan Franc is a count data and, which is well-suited to be estimated by the Poission model as this estimation technique takes into consideration such data generating process of the dependent variable. The Poisson model (a count data model) is advantageous as it is also suitable for modelling that has zero values particularly if consumers have zero WTP for them. In addition, the model is well- well-behaved and consistent even in the presence of overdispersion and heteroscedasticity inherent in count data (Santos and Silva Trenyo, 2010; 2011).

5.0. Discussion and Results

This section presents the results of the baseline regression models after which those that depict how intrahousehold gender and power dynamics influence the willingness to pay for micronutrients food in the forms of both fortified maize flours and biofortified beans.

5.1. Baseline Estimates – Determinants of Willingness to Pay for the (bio)fortified Food Products

Table 2 report the regression estimates of the different factors influencing the willingness to pay for both fortified maize flours and biofortified beans in Rwanda informal settlements. Column (1) of Table 2 reports the estimated impacts at the individual respondent level. In column (2), spousal factors such were factored into the regression model, while columns (2) and (4) dwell more on the role of awareness and knowledge of bio(fortified) food in eliciting the willingness to pay.

First, focusing on the results from column (1), at the individual level, females are more willing to purchase the bio(fortified) food relative to their male counterparts by 0.053**. Furthermore, compared to the reference age of 0 to 5 years, those who have married for a

longer period (17 years and above) have a relatively lower willingness to pay for the healthy micronutrient food. In terms of age, with respect to the reference age group (20 to 29 years), responders that are slightly older are more willing to purchase the micronutrients food. This corresponds to those aged 40 and above. Furthermore, in terms of the occupational composition of the respondents, relative to the reference occupation which is agricultural activities other than farming, civil and public servants revealed the highest wiliness to pay, which is closely followed by those in private salary earning occupation, with those involved in farming activities and artisans, have the least willingness to pay in decreasing order. Besides, in relation to educational status, those having a primary education decreases the willingness to pay, while those with secondary and vocational education have positive willingness to pay, albeit the effects are not significant for these categories of the responders. However, those with tertiary education signaled positive and significant willingness to pay for the micronutrient food. These later results signify the role of education in stimulating healthy diet. Besides human resources, proxied by educational level, monetary resources measured by the respondents' monthly income is a driver of their willingness to pay for such relatively expensive food products.

Next, we consider the effects of household characteristics – household size, number of children which are under-five years, and fertility, which is proxied by the number of the respondents' children. Our results show both household size and fertility to have negative effects on the respondent's willingness to pay, with actual effect muted. More specifically, in relation to the fertility variable, our results implies that an addition of each child in the household do not significantly influence the respondent willingness to pay for the bio(fortified) products. In relation to the children under five years, relative to the reference group of respondents without any under-five year child, those with under-five children have lower willingness to pay for the bio(fortified) food, with the unwillingness to pay increasing for the first and second child, before stabilizing at the third child after which the willingness to pay decreases by 0.632 for the 5^{th} child. The results in relation to unwillingness to pay for the food products is rather reflect and explain the prevalence of Rwanda where a high number of children aged 6 to 59 months are undernourished. According to the most recent Rwanda Demographic and Health Survey (DHS), In Rwanda, undernutrition among children is a huge public health concerns as 33.1% of children under five years are stunted, reaching a peak of 40% in childern that are between 24 to 35 months, with the high prevalence in Western and Northern Rwanda. In addition, 6.7% are malnourished, 8% are underweight, and 37% are anemic (Rwanda DHS 2019-20). Thus, intensive nutrition campaigns involving targeted consumer education and awareness on the benefits and importance of the consumption of such (bio)fortified products are germane.

Further, we consider some factors related to the products under consideration *vis à vis* the frequency of its consumption and the attributes that might influence their consumption. In reference to the reference category which is "always", those who indicated that they sometimes (one to two days a week) consume the bio(fortified) products have lower willingness to pay for the products. In contrast, those who rarely consume (one or two days a month or thereabout) indicated they are willing to pay relatively more for the products. Intuitively, these results might be due to the fact that those who rarely consume beans or maize flour might opt to pay for relatively expensive bio(fortified) products as such purchases are done once in a while by them. Furthermore, in relation to the products' attribute, two of such were included in the analysis – attractiveness of the product in terms of appearance or packaging, and availability of nutrition information about the products. Our results in column (1) reveals that these are great markers for willingness to pay for the

products, particularly the appearance of the products. Clearly, labelling and packaging requirements can enhance the willingness to pay for these products – an advantage which can be exploited by the relevant competent Rwanda Authority to stimulate the consumption of (bio)fortified products over their conventional counterparts.

Furthermore, psychological factors such as perception and consciousness about nutrition can be important stimulating driver of willingness to pay as evidenced from our results. More specifically, respondents who revealed that they have been very concerned and/or conscious about being nutrition deficient are more willing to pay for the healthy micronutrient products. However, those who indicated that they dwell over nutrition information as they are important for making purchase decisions have a lower willingness to purchase the healthy food. This latter result indicates the need to ensure more sensitization of the populace to information about healthy food diets to enable them to make healthy consumption decisions particularly for those who are always reluctant to purchase products when health and nutrition information are inadequate or symmetric. While the Rwanda government is already doing such sensitization, there is a need to ensure the information is well-understood and digested by the intended or targeted groups to ensure a wholehearted embracement of the products.

On a related note, the variable capturing, the products' awareness, or knowledge about one or both of the fortified maize flour and biofortified beans indicates that such knowledge increases the willingness to pay for the bio(fortified) products. This result is as expected given the sensitization of the products by Rwandan Authorities in the media. This result tallies with those of De Groote et al., (2018) in the case of fortified pearl millet in Senegal; and Chege et al. (2019) in the cases of fortified maize flour in both Kenya and Uganda; and Oparinde (2016c) in the case of biofortified beans farmers in Rwanda, which find that information dissemination is a powerful tool for propelling the willingness to pay for fortified food. Finally, in relation to some of the fixed effects that were included in the regression model, the results shows that the respondents have a higher willingness to pay for fortified maize flour than for the biofortified beans, which intuitively might be because the latter is more pricy than normal conventional beans that have not been biofortified. In addition, those in urban areas have a higher willingness to pay than those in rural areas.

The role of the spouse

In column (3) includes some spousal control variables, in addition to the discussed variables that were discussed in column (1). First, in terms of the occupational composition of the respondents, relative to the reference occupation which is agricultural activities other than farming, there seems to be no significant difference among the various occupations. However, respondents whose spouses are retailers or market woman/man have lower willingness to pay. Intuitively, this might be attributed to the fact that unlike other occupations. market women have access to a variety of products both conventional and bio(fortified) products which influence their revealed preference. Also, relation to spousal education, respondents' spouse with only primary education has a lower willingness to pay, with no significant effect for the other educational categories. Similarly, spouse monthly income has no significant in driving the willingness to pay for the micronutrient food, indicating a hint of intrahousehold power dynamic that might be at play.

The role of Information

Next, we further investigate the role of awareness and knowledge of the products on their willingness to pay. We had asked the separate questions about whether or not the respondent

has knowledge and awareness of fortified and biofortified products. Thus, we ascertain the impact of such knowledge of each of the products among the respondents in eliciting their willingness to pay by including these two variables into the regression model while omitting the previous model used to capture awareness of the products. Column (3) reveals the results of this exercise, with respondents' knowledge about biofortified beans significantly propelling their willingness to pay for it when presented with the product by the researcher. However, this was not the case for fortified maize flours where the impact of their knowledge of it on their willingness to pay for it is indistinguishable from zero.

Given that the role of education in willingness to pay for the relatively expensive products with those with higher education having a higher willingness to pay, as education might affect the processing and usage of such information, we thus investigate the role of such information among the non-highly and highly educated respondents. Thus, we proceed by interacting a dummy variable which assumes the value of one for respondents with higher education, zero otherwise with the information variable that was used in column (2). To prevent collinearity, we omitted the variable capturing educational levels of the respondent from the regression. The results of this exercise, as reported at the bottom of column (4) show that among those who are knowledgeable and aware about the products, highly educated respondents demonstrated a relatively higher willingness to pay (0.163) relative to the other respondents with no such qualification (0.097). The observed willingness to pay due to knowledge and information about the products is mainly explained by the highly educated populace. More sensitisation of information needs to be targeted in a way that those without advanced or tertiary education would be easy to process for them to enable a stimulated demand for health diets from them. The Rwandan authority has already engaged in the sensitization campaigns in mass media outlet regarding the (bio)fortified products, however, many of the respondents reported that they were aware of the existence of the (bio)fortified food products but cannot vividly reiterate their important neither can they distinguish them from the conventional ones when buying in the markets. Thus, such consumer information needs to be in a more user-friendly format so as to ensure easy processing and understanding by the uneducated or less educated populace. In addition, labelling requirements need to be combined with the digital sensitization campaigns to showcase the nutrition advantages of (bio)fortified products over their conventional counterparts.

Table 2: Determinants of Willingness to Pay for the (bio)fortified Food Products

	(1)		(2)		(3)		(4)	
	Coef.	**S.E.**	**Coef.**	**S.E.**	**Coef.**	**S.E.**	**Coef.**	**S.E.**
Gender								
Female	0.053**	(0.023)	0.050	(0.035)	0.056	(0.039)	0.049	(0.036)
Age								
30 to 39	0.072	(0.051)	0.069	(0.080)	0.057	(0.038)	0.069	(0.080)
40 to 49	0.118***	(0.015)	0.101***	(0.030)	0.113*	(0.063)	0.099***	(0.021)
50 to 64	0.217***	(0.056)	0.173***	(0.052)	0.220***	(0.030)	0.165***	(0.051)
> 65	0.262***	(0.099)	0.280***	(0.084)	0.259***	(0.026)	0.282***	(0.084)
Marriage Age								
5 to 10 years	-0.015	(0.040)	-0.050	(0.056)	-0.200***	(0.048)	-0.055	(0.056)
11 to 16 years	0.002	(0.045)	-0.025	(0.034)	-0.115***	(0.043)	-0.028	(0.039)
17 to 22 years	-0.234***	(0.072)	-0.236***	(0.064)	-0.360***	(0.083)	-0.234***	(0.073)
> 22 years	-0.272*	(0.144)	-0.309***	(0.119)	-0.457***	(0.050)	-0.317***	(0.115)
Occupation								
Civil or public servant	0.196***	(0.027)	0.197***	(0.025)	0.352***	(0.066)	0.198***	(0.039)
Farm Activities	0.071*	(0.040)	0.045	(0.030)	0.008	(0.081)	0.039	(0.030)
Other salary earner (private)	0.178***	(0.044)	0.133***	(0.048)	0.180***	(0.058)	0.129***	(0.048)
Retailer /market woman/man	0.115***	(0.024)	0.094**	(0.043)	0.099	(0.071)	0.091**	(0.045)
Artisan	0.076***	(0.023)	0.064**	(0.026)	0.106	(0.087)	0.058***	(0.021)

Education								
Primary education	-0.009	(0.038)	-0.004	(0.060)	-0.077	(0.072)		
Vocational education	0.043	(0.076)	0.025	(0.120)	-0.061	(0.112)		
Secondary education	0.090	(0.061)	0.040	(0.126)	-0.057	(0.128)		
Tertiary education	0.230***	(0.053)	0.105	(0.146)	-0.004	(0.145)		
Household Size	-0.024	(0.038)	-0.017	(0.037)	0.004	(0.044)	-0.017	(0.037)
Monthly Income								
Respondent	0.089***	(0.019)	0.108***	(0.021)	0.034	(0.036)	0.112***	(0.030)
Spouse			-0.015	(0.065)	0.001	(0.053)	-0.016	(0.068)
Under 5 Years Children								
1	-0.153***	(0.047)	-0.157***	(0.049)	-0.222***	(0.033)	-0.157***	(0.047)
2	-0.261***	(0.048)	-0.285***	(0.052)	-0.300***	(0.074)	-0.288***	(0.051)
3	-0.167	(0.150)	-0.183	(0.145)	-0.259**	(0.118)	-0.189	(0.134)
5	-0.632***	(0.175)	-0.588***	(0.162)	-0.611***	(0.130)	-0.569***	(0.151)
Number of Children	0.000	(.)	0.000	(.)	0.000	(.)	0.000	(.)
0	-0.377	(0.411)	-0.392	(0.384)	-0.400	(0.471)	-0.382	(0.360)
1	-0.202	(0.388)	-0.187	(0.367)	-0.204	(0.453)	-0.180	(0.344)
2	-0.073	(0.334)	-0.038	(0.315)	-0.037	(0.369)	-0.028	(0.287)
3	-0.058	(0.279)	-0.014	(0.263)	0.009	(0.289)	-0.005	(0.234)
4	-0.088	(0.269)	-0.036	(0.254)	-0.037	(0.284)	-0.027	(0.233)
5	0.073	(0.253)	0.084	(0.244)	0.123	(0.246)	0.084	(0.231)
6	0.129	(0.231)	0.156	(0.232)	0.075	(0.233)	0.158	(0.213)
Frequency of Consumption								
Often	0.040	(0.037)	0.036	(0.040)	0.074	(0.051)	0.034	(0.040)
Sometimes	-0.087*	(0.046)	-0.062	(0.054)	-0.009	(0.053)	-0.062	(0.061)
Rarely	0.056**	(0.026)	0.008	(0.033)	0.093	(0.110)	-0.001	(0.057)
Products' Attributes								
Attractive Appearance or Package	0.116***	(0.044)	0.119**	(0.059)	0.046	(0.077)	0.119**	(0.056)
Availability of Nutrition Information	0.082***	(0.015)	0.083***	(0.015)	0.126***	(0.019)	0.086***	(0.016)
Nutrition Consciousness/Perception								
Nutrition Health Infor Importance	-0.351***	(0.039)	-0.364***	(0.081)	-0.354***	(0.134)	-0.363***	(0.067)
Nutrition Deficiency Consciousness	0.067***	(0.020)	0.057***	(0.019)	0.018	(0.021)	0.055***	(0.015)
Product Awareness/Knowledge								
Bio(fortified) food	0.083***	(0.027)	0.092***	(0.018)				
Fortified Food Products					-0.018	(0.023)		
Biofortified Food Products					0.133**	(0.053)		
Product Effect: Fortified Maize Flour	0.085**	(0.035)	0.082**	(0.039)	0.047	(0.055)	0.088***	(0.033)
Locality: Urban Areas	0.175***	(0.020)	0.161***	(0.017)	0.048**	(0.020)	0.164***	(0.015)
Spouse's Occupation								
Civil or public servant			-0.065	(0.077)	0.021	(0.080)	-0.066	(0.075)
Farm Activities			-0.006	(0.091)	-0.035	(0.094)	-0.012	(0.088)
Other salary earner			-0.006	(0.060)	0.016	(0.064)	-0.004	(0.063)
Retailer/market woman/man			-0.082**	(0.035)	-0.089*	(0.046)	-0.082**	(0.037)
Artisan			-0.051	(0.053)	-0.021	(0.039)	-0.043	(0.050)
Spouse Education								
Primary education			-0.042***	(0.009)	-0.034*	(0.018)	-0.034*	(0.020)
Vocational education			-0.006	(0.083)	-0.009	(0.096)	0.011	(0.093)
Secondary education			0.023	(0.058)	0.001	(0.075)	0.045	(0.059)
Tertiary education			0.140	(0.089)	-0.030	(0.138)	0.171**	(0.068)
Product Knowledge # Highly Educated								
Product Awareness:								
Not Highly Educated							0.097***	(0.023)

Highly Educated							0.163***	(0.043)
Product Unawareness:								
Highly Educated							0.081	(0.194)
Constant	7.008***	(0.066)	7.074***	(0.087)	7.206***	(0.063)	7.084***	(0.076)
Observations	**327**		**318**		**260**		**318**	

Note: Reported standard errors are clustered at the province level. Clustered robust standard errors in brackets; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Product, province, district and locality fixed effects are included in the regressions.

5.2. Interhousehold Power Dynamics

The results in Table 2 had shown that many of the spousal variables are not significant and thus, do not complement the respondents' willingness to pay. This prompted an investigation of how intrahousehold power dynamics among the respondents and their spouses would affect respondents' willingness to pay for expensive micronutrient food products.

In accordance with equation (3), four measures of power dynamics among female and male respondents and their spouses as considered in this the estimated models. These are intrahousehold income gender gaps, intrahousehold educational status, intrahousehold employment status, and intrahousehold decision bargaining power. Besides, the implications of some extant household barriers are also closely investigated.

Thus, Table 3 reports the estimated impacts of the respondents' intrahousehold power dynamics on their willingness to pay for the bio(fortified) products. Column (1) reports the aggregated estimates for the married couples, while the differential effects for both female and male respondents were separately reported in columns (2) and (3), respectively. As depicted in column (1), starting with income and finances, at the household level, the evidence suggests that increase in the respondent's monthly income over the spouse increases the average willingness of a typical respondent to purchase the micronutrient food product, although this is marginally significant. In other words, respondents with a higher income have a marginal bargaining power that positively influences the willingness to pay of such respondents. Besides, in relation to finances of food purchases, our results show that the respondent willingness to pay for the bio(fortified) products is higher only when it is the wife that is financing the food expenditure as shown by the coefficient (0.209), relative to when the husband of the respondent finances food expenditures in the household (0.093). These results support the importance of women's control of household resources. These results are in line with the proposition that women access to financial resources leads to the channelling of such to the purchase of nutritious food and human capital development (Quisumbing and Maluccio 2003; Kamath and Dattasharma 2017). In addition, further evidence suggests that joint finance of household expenditures to be insignificant, implying a rejection of the collective household model in favour of the unitary household one which disproportionately favour the household when the wife is the one financing household expenditures.

Furthermore, in relation to power bargaining resulting from educational status, our results indicate a muted effect on willingness to pay even when the educational levels of the respondents are higher than their respective spouses. However, their current employment status seems to stimulate the respondents' willingness to pay irrespective of whether the spouse is employed or not. On the one hand, cases when the respondent is employed and the spouse is not, increases the willingness by 0.238, while it is slightly lower at 0.185 when both are employed. In essence, the respondents seem to have a higher bargaining power when their spouses are unemployed, which stimulates more willingness to pay by them, perhaps due to their spouse having no income.

Next, we examine how intrahousehold purchase decisions affect the willingness to pay for the

relatively expensive bio(fortified) products. We had distinguished between the unitary decision makers – the respondents, and their spouses – and in relation both spouses as collective decision makers. In relation to these variables, at the aggregated household level, their effects are positive but not significant, which drive our pursuits of the disaggregated impacts on both the male and female respondents.

In relation to household barriers, we have included two distinct barriers relating to food consumption or thereof in the regression analysis. These are unequal food quality consumption in the household and emotional and psychological violence inflicted on the respondents by their spouses or others due to non-available of food. First, we find evidence that the extant unequal distribution of food quality consumption in the household lowers the willingness of the respondent to pay for the nutritious bio(fortified) products presented to them. The literature has indicated the prevalence of unequal consumption of nutritious products in households, including in Rwanda, disproportionately favouring men where women reserve nutritious food for their spouses in line with cultural norms (USAID, 2020; Farnworth et al., 2023). Second, respondents who have experienced emotional and other psychological violence from their spouses due to food related problems signalled a reduced willingness to pay although the effect is not statistically significant at the conventional level.

Finally, in relation to the other explanatory variables, the impacts of all other covariates previously explained remain the same with the exception of the respondents that indicated that they sometimes consume the bio(fortified) products, which is still negative but now insignificant at the conventional level.

5.2.1. Disaggregated Gender Effects

We now turn to examine the individual gender effects of the tools of intrahousehold bargaining and power dynamics examined in column (2) of Table 3. Column (2) reports the effects for the female respondents, with those for the male respondents reported in column (3). The results in both columns are examined simultaneously to enable a deeper insight into the disaggregated gender differences of the respondents. A quick glass at the results in both columns suggest that relative to their spouses, females seem to have a higher bargaining power when their income is higher than their spouses, and when their spouses make food purchase decisions jointly with them. For the male respondents, such higher bargaining power is particularly demonstrated when they are employed, and their spouses are not.

More specifically, intrahousehold income gap is significantly positive in column (2). This implies that as women's income increases relative to their spouses, their willingness to pay for such nutritious food increases. However, in column (3) the coefficient on the intrahousehold income gap for the male respondent indicates that as men's willingness to pay decreases as their income increases relative to their spouses, although the event is not significant at the conventional level. In sum, women have a higher willingness to pay when they have a higher income than their spouses, and this evidence is not observed in the case of men. Also, in terms of food finances, in relation to the female respondents, they tend to exhibit a high willingness to pay for the product irrespective of who finances household consumption, with higher willingness demonstrated when the husband finances the consumption. On the part of the male respondent, they are less willing to pay if they are the sole finance of the household food consumption, probably because they do not want to provide more money than is already being provided by them. Nonetheless, their willingness to pay rises if the burden of financing food falls to their spouses, while demonstrating zero willingness to pay if they co-finance household food expenditures with their spouses. In

essence, this household dynamics reveals that women are ever willing to pay for health and nutritious food products irrespective of who finances the household food consumption expenses, while men are more reluctant to purchase such unless the finance is from their spouses.

Next, we consider the disaggregated gender effect of both intrahousehold educational levels and the couple's employment status. In relation to the former, we find no evidence that women having a higher educational level than their spouse influences their willingness to pay for the bio(fortified) products (column (2). This result also goes for the male respondents (column 3). However, in regard to the latter, being employed and in addition to having a spouse that is also employed increase women's willingness to pay (column 2). This effect is also applicable to their male counterparts (column 3), with the effect bigger when for males than females. Furthermore, again from the same column, it could be seen that males also seem to have a higher bargaining power when they are employed but their spouses are not, which exert a higher influence on their willingness to pay of about 0.599 on them. This is in contrast to what is depicted in column (2) regarding the female respondents whose willingness to pay is indistinguishable from zero when their spouses are unemployed, in spite of them being employed. In sum, women have high bargaining power when they and their spouses are employed, leading to better intrahousehold outcomes (purchase of nutritious food) but not so when their spouses are unemployed. Men on their part seem to enjoy significant bargaining power when they are employed, irrespective of whether or not their spouses are employed, with the intrahousehold outcome or effect higher for them when their spouses are unemployed. Drawing from the happiness literature, we attribute this to the fact that women are usually unhappy when their spouses are unemployed (Kim and Do, 2013: Blom and Perelli-Harris, 2021), however, the reaction to having an unemployed spouse varies by gender with females less happy when their spouses are unemployed while males are less concerned about this (Blom and Perelli-Harris, 2021). Intuitively such unhappiness can in part explain the unwillingness to pay for the (bio)fortified food products when she is employed and the spouse is not.

Turning to the variables capturing intrahousehold decision making power, in respect to the female respondents, our results in column (2) show that being sole food purchase decision maker increases their willingness to pay by 0.210. In addition, they revealed an equal willingness to pay when the decision maker is their spouses. However, being a joint decision maker with their husbands is a bit more in favour to them as their willingness to pay increased to 0.216, suggesting that the collective decision model only brings a slightly in favour of their household outcome in regard to the purchase of the nutritious food, as the marginal effect of moving from being a sole decision maker to being a joint decision maker is very small, albeit favourable. However, in the case of men as depicted in column (3), their involvement in food purchase decisions is somehow inimical as their willingness to pay reduces by 0.236 when they are the sole food purchase decision makers. Furthermore, this they are further less willing to pay when their spouses are the food purchase decision makers, with their willingness to pay for the bio(fortified) food increasing from 0.366 to 0.337 when they are joint decision makers with their spouses. These results support the recent findings that women's sole or joint involvement in household expenditure related decisions lead to improved dietary quality relative to when men are solely involved in decision making (Jones et al., 2014; Sariyev et al 2021).

Lastly, in relation to the household barriers, the extant unequal food quality consumption in the household does not significantly debar females from wanting to purchase the

bio(fortified) products, probably because women have taken these practices as a cultural norm entitlement. In fact, a Rwanda study by the USAID reported that women in Rwanda posit men as having the right to eat more expensive nutritious food since men provide the source of the food and also as a sign of respect (USAID, 2020). However, in the case of men, such an unequal food quality consumption reduces their willingness to pay for the bio(fortified) products. In this case, evidence suggests that some men seldom care about nutritious food consumed at home, primarily because they consume more nutritious food outside their home in male-dominated spaces or restaurants (USAID, 2020). In fact, men are reported to consume highly nutritious food including animal sourced food such as meat while women are seen to purchase other food categories such as leafy vegetables and beans (USAID, 2021). This result shows men to failing to prioritize household nutrition which is aggravated by gender restrictive norms such as the cultural entitlement and masculinities which perpetuate gender inequalities undermine women's equitable consumption of household resources while enabling men access to more resources (Cislagi, et al., 2018; Farnworth et al., 2023).

Further, in relation to emotional and psychological violence, our results suggest that being women that are exposed to emotional and psychological violence from their spouses due to food related problems, show a reduced willingness to pay for the nutritious and healthy bio(fortified) food, while the effect muted for the males. This result supports the findings in the literature that domestic violence leads to poor nutritional outcomes as it prompts the victims to consume less quality food or unhealthy food consumption (Lentz, 2018; Smith et al., 2020). In the case of women, Lentz (2018) finds that women consume lower quality food in relation to conflict avoidance. This is so as violence elevates the body's cortisol hormone level triggers the consumption of unhealthy food (Greenfield and Marks, 2009; Torres, et al., 2007).

Table 3: Effects of Intrahousehold Power Dynamics and Decision Making

	(1)		(2)		(3)	
	Coef.	**S.E**	**Coef.**	**S.E**	**Coef.**	**S.E**
Gender						
Female	0.088**	(0.039)				
Age						
30-39	0.091	(0.074)	0.167*	(0.101)	-0.024	(0.055)
40-49	0.151***	(0.044)	0.210*	(0.120)	0.100	(0.105)
50-64	0.271**	(0.112)	0.277*	(0.159)	0.119	(0.175)
> 65	0.206	(0.155)	0.210	(0.143)	0.122	(0.167)
Marriage Age						
5 to 10 years	-0.048	(0.074)	-0.026	(0.049)	-0.083***	(0.019)
11 to 16 years	-0.058	(0.062)	-0.003	(0.048)	-0.232**	(0.102)
17 to 22 years	-0.294***	(0.110)	-0.332***	(0.099)	-0.375**	(0.157)
> 22 years	-0.323*	(0.185)	-0.117	(0.176)	-0.380*	(0.222)
Household Size	-0.019	(0.043)	-0.039	(0.033)	0.017	(0.028)
Under 5 Years Children						
1	-0.129***	(0.046)	-0.123***	(0.032)	-0.103	(0.065)
2	-0.258***	(0.052)	-0.276**	(0.129)	-0.203***	(0.070)
3	-0.111	(0.137)	0.014	(0.082)	-0.588***	(0.120)
5	-0.723***	(0.108)	-0.596**	(0.235)		
Number of Children						

0	-0.232	(0.380)	-0.211	(0.334)	-0.104	(0.224)
1	-0.148	(0.349)	-0.041	(0.287)	-0.112	(0.241)
2	-0.006	(0.308)	-0.047	(0.231)	0.067	(0.179)
3	0.032	(0.222)	0.043	(0.259)	0.096	(0.151)
4	0.013	(0.241)	0.018	(0.173)	0.234*	(0.128)
5	0.096	(0.210)	0.050	(0.221)	0.196	(0.126)
6	0.184	(0.241)	0.216	(0.273)	0.197	(0.161)
Frequency of Consumption						
Often	0.014	(0.035)	-0.018	(0.039)	0.036	(0.050)
Sometimes	-0.047	(0.045)	-0.094*	(0.053)	-0.093	(0.066)
Rarely	0.076**	(0.029)	0.104*	(0.060)	0.182***	(0.045)
Product Attributes						
Attractive Appearance or Package	0.121***	(0.040)	0.120***	(0.035)	0.171***	(0.028)
Availability of Nutrition Information	0.089***	(0.025)	0.063***	(0.014)	0.100*	(0.058)
Nutrition Perception & Consciousness						
Importance of Nutrition Health Information	-0.286***	(0.054)	-0.078	(0.109)	-0.977***	(0.072)
Nutrition Deficiency Consciousness	0.028*	(0.016)	0.065**	(0.030)	0.011	(0.035)
Household Barriers						
Unequal Food Quality in Household	-0.199***	(0.055)	-0.049	(0.043)	-0.345***	(0.045)
Emotional and Psychological Violence	-0.023	(0.120)	-0.259*	(0.135)	-0.063	(0.097)
Income and Finances						
Intrahousehold Income Gap	0.065*	(0.038)	0.175**	(0.082)	-0.001	(0.019)
Husband Finances	0.092**	(0.046)	0.175***	(0.063)	-0.081*	(0.045)
Wife Finances	0.209***	(0.064)	0.167***	(0.062)	0.418***	(0.060)
Husband and Wife Finance	0.031	(0.025)	0.147***	(0.054)	-0.068	(0.058)
Intrahousehold Educational Level						
Higher Status by Respondent	-0.020	(0.037)	-0.001	(0.050)	0.002	(0.035)
Intrahousehold Employment Status						
Employed Respondent and Unemployed Spouse	0.238***	(0.077)	0.080	(0.105)	0.599***	(0.039)
Employed Respondent and Spouse	0.185**	(0.076)	0.187**	(0.083)	0.549***	(0.048)
Occupation	0.000	(.)	0.000	(.)	0.000	(.)
Farm Activities	-0.210***	(0.041)	-0.391***	(0.075)	-0.133**	(0.062)
Other salary earner (private)	-0.068**	(0.029)	-0.250***	(0.071)	0.061***	(0.017)
Retailer or market woman/man	-0.136***	(0.043)	-0.293***	(0.080)	-0.063*	(0.037)
Artisan	-0.187***	(0.050)	-0.410***	(0.065)	-0.138*	(0.073)
Intrahousehold Purchase Decisions						
Respondent Only	0.066	(0.152)	0.210**	(0.102)	-0.236***	(0.043)
Respondent's Spouse Only	0.094	(0.206)	0.210***	(0.079)	-0.366***	(0.120)
Respondent and Spouse	0.092	(0.159)	0.216**	(0.089)	-0.337***	(0.072)
Knowledge and Awareness:	0.070***	(0.018)	-0.084	(0.090)	0.265***	(0.049)
Bio(fortified) Food						
Product Effect: Fortified maize	0.122***	(0.034)	0.095*	(0.058)	0.178***	(0.020)
Locality: Urban Areas	0.133***	(0.026)	0.166***	(0.029)	0.070*	(0.042)
Constant	7.196***	(0.146)	7.132***	(0.235)	7.829***	(0.174)

Fixed Effects						
Product	Yes	Yes	Yes	Yes	Yes	Yes
District	Yes	Yes	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes	Yes	Yes
Locality	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	**315**		**175**		**140**	

Note: Reported standard errors are clustered at the province level. Clustered robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3. Intrahousehold Power Dynamics and Children Under Five Years

Our results in Tables 2 and 3 had revealed both genders having lower willingness to pay when children under five years are present. Further evidence in Table 3 also shows females to have more bargaining power over income with positive effects on willingness to pay for the bio(fortified) food products. Such power dynamics might impact on their allocation of such resources to their under-5 aged children, in terms of their willingness to purchase the micronutrient food products for these categories of children. Thus, we assess how the prevailing intrahousehold power dynamics in relation to income affect household willingness to allocate household resources to purchase micronutrient food for children under 5 years. To proceed, we interacted the variable capturing household income gap with the one depicting the number of respondents' children, which is then interacted with the gender dummy variable to enable us to differentiate the impact along gender lines. The results of this exercise are provided in columns (1) and (2) of Table 8. Column 1 included this interaction along with a separate gender dummy, while in column (2), the gender dummy was excluded from the regression model to enable the identification of the total effect for all the genders.

In relation to the estimated coefficient reported in columns (1) and (2), a rise in women's intrahousehold income-related bargaining power prompt them to want to allocate more income resources for the consumption of the nutritious bio(fortified) food their under-five aged children as their willingness to pay for their under-five year children increases as their income increases relative to their spouse. More specifically, for the first child, the sampled women marginally increase the allocation of their monetary resources to the first under-aged child, with the effect marginal as the impact is marginally significant, while the effect exploding when the number of kids is five. In other words, the women bargaining power increases their willingness to pay for the nutritious bio(fortified) food, with the willingness to pay increasing with the increase in the number of children, particularly for the first and second child, before stabilizing at the third child after which the willingness to pay escalated by 21.119 when the number of underaged children is five. These results are in line with those of Ringdal and Sjursen (2020) in their study on Tanzania, which finds a rise in women's bargaining power leads to a rise in the allocation of resources to ensure better child's welfare.

In contrast, in relation to the male respondents, our results indicate that men tend to allocate monetary resources away even from their under-five aged children irrespective of their possession of high intrahousehold bargaining power such that their income is higher than their spouses. This is so as the estimated coefficient on the interaction term reveal that men to be more willing to pay if there is no under-five child, have zero willingness to pay for the bio(fortified) products when the children are one or two but a higher unwillingness to pay of about 19.194 when they have multiple under-five kids. The results show that the addition of each child in the household does not significantly influence the respondent's willingness to pay for the bio(fortified) products. These results show the poor outlook of men regarding

household nutrition as indicated by the disconnection between masculinity and household nutrition. This is posited to be due to male poor nutrition knowledge attributed to their historical marginalization or poor participation in nutrition intervention in Rwanda as nutrition interventions are skewed towards women and children (Farnworth, 2023). Such knowledge divide can lead to poor informed purchase behaviour even towards children under-five aged children despite the fact that they are a vulnerable group in Rwanda in terms of the prevalence of undernutrition among them. These results indicate the need for and importance of nutrition interventions involving men as critical members of households and agents of change which can result in better intrahousehold cooperation between spouses and the emergence of non-discriminatory gender relation or the suppression of restrictive gender norms. Along with their spouses, male participation is imperative as children whose father participated in maternal and children nutrition activities reported better nutrition outcomes (Kansiime et al., 2017).

Table 4: Income Bargaining Power and Willingness to Pay for Under-5 Years Children

	(1)		(2)	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Gender				
Female	0.114*	(0.060)		
Age				
30-39	0.095*	(0.055)	0.084	(0.055)
40-49	0.151***	(0.052)	0.107	(0.066)
50-64	0.346***	(0.113)	0.271***	(0.102)
> 65	0.225	(0.157)	0.149	(0.131)
Marriage Age				
5-10	-0.025	(0.072)	-0.018	(0.065)
11-16	-0.012	(0.061)	0.005	(0.053)
17-22	-0.235**	(0.091)	-0.188***	(0.065)
> 22	-0.242	(0.180)	-0.210	(0.173)
Household Size	-0.031	(0.051)	-0.028	(0.052)
Number of Children				
1	-0.011	(0.080)	-0.010	(0.082)
2	0.109	(0.124)	0.115	(0.130)
3	0.136	(0.229)	0.140	(0.237)
4	0.106	(0.162)	0.117	(0.179)
5	0.210	(0.271)	0.194	(0.259)
6	0.303	(0.389)	0.279	(0.378)
7	0.153	(0.398)	0.132	(0.411)
Frequency of Consumption				
Often	0.002	(0.029)	0.007	(0.030)
Sometimes	-0.045	(0.041)	-0.052	(0.042)
Rarely	0.130***	(0.034)	0.128***	(0.031)
Products' Attributes				
Attractive Appearance or Package	0.136**	(0.056)	0.137**	(0.059)
Availability of Nutrition Information	0.097***	(0.028)	0.090***	(0.026)
Nutrition Perception & Consciousness				
Importance of Nutrition Health Information	-0.283***	(0.085)	-0.293***	(0.067)
Nutrition Deficiency Consciousness	0.027**	(0.013)	0.026**	(0.011)
Household Barriers				
Unequal Food Quality in Household	-0.236***	(0.075)	-0.223***	(0.067)

Emotional and Psychological Violence	-0.050	(0.132)	-0.021	(0.114)
Under 5 Years Children # Intrahousehold Income Gap # Gender				
Female				
0	0.240	(0.181)	0.149	(0.171)
1	0.112*	(0.060)	0.107**	(0.049)
2	0.541***	(0.147)	0.399***	(0.134)
3	1.902	(1.921)	1.748	(2.322)
5	21.119***	(5.142)	20.632***	(4.533)
Male				
0	0.683***	(0.167)	0.522***	(0.125)
1	0.468	(0.344)	0.296	(0.209)
2	-0.007	(0.044)	-0.013	(0.046)
3	-19.194***	(2.549)	-22.645***	(1.938)
5	0.000	(.)	0.000	(.)
Finances				
Husband Finances	0.101*	(0.053)	0.091*	(0.051)
Wife Finances	0.207***	(0.073)	0.211***	(0.080)
Husband and Wife Finance	0.022	(0.034)	0.019	(0.034)
Intrahousehold Educational Level				
Higher Status by Respondent	-0.020	(0.043)	-0.023	(0.043)
Intrahousehold Employment Status				
Employed Respondent and Unemployed Spouse	0.191***	(0.046)	0.167***	(0.052)
Employed Respondent and Spouse	0.193***	(0.047)	0.176***	(0.051)
Occupation				
Farm Activities	-0.223***	(0.043)	-0.229***	(0.041)
Other salary earner (private)	-0.076	(0.049)	-0.076	(0.049)
Retailer or market woman/man	-0.148***	(0.045)	-0.133***	(0.040)
Artisan	-0.218***	(0.042)	-0.227***	(0.042)
Intrahousehold Purchase Decisions				
Respondent Only	0.041	(0.151)	0.072	(0.144)
Respondent's Spouse Only	0.084	(0.212)	0.065	(0.200)
Respondent and Spouse	0.051	(0.146)	0.065	(0.145)
Knowledge and Awareness	0.092***	(0.018)	0.098***	(0.015)
Bio(fortified) Food				
Product Effect: Fortified maize	0.127***	(0.038)	0.126***	(0.039)
Locality: Urban Areas	0.137***	(0.027)	0.137***	(0.031)
Fixed Effects				
Product	Yes		Yes	
District	Yes		Yes	
Province	Yes		Yes	
Locality	Yes		Yes	
Constant	7.324***	(0.132)	7.265***	(0.105)
Observations	**315**		**315**	

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3. Lactating and Pregnant Women

The preceding analysis as reported in Tables 2 and 3 indicates that relative to men, women have a higher willingness to pay for the bio(fortified) products as shown by the estimated coefficients on the gender dummy variable, and their willingness to allocate more resources

to ensure better household outcomes including for their under-five aged children. However, the composition of our data also includes pregnant women and lactating mothers, and women which do not fall in either of these two categories, which the gender effect aggregated the impacts for. Pregnant women and lactating women need micronutrients as adequate nutrition is vital during pregnancy and lactating period due to increased nutritional requirements necessary to ensure maternal, fetal and newborn health and nutrition well-being.

Thus, we also provide an insight into their willingness to pay for bio(fortified) food products, relative to men and the other women category. This is done by introducing a dichotomy dummy variable into the regression model presented in Table 3. This dummy variable assumes the value of one if the respondent is pregnant, two if the respondent is lactating, zero otherwise. The result of this exercise is presented in Table 4 below. Column (1) reports the effects for both lactating and pregnant women using the whole sample, while the estimated effects are presented in column (2) for the sub-sample of the female respondents only.

In relation to the estimated results, in column (1), relative to the reference group (men, non-lactating and non-pregnant women), pregnant women reveal a lower willingness to pay of about 0.098, while lactating women's willingness to pay for the bio(fortified) product is even lower at 0.182. These results complemented what was obtained in column (2) as similar conclusions were also derived in relation to pregnant women and lactating mothers, where the willingness to pay of pregnant and lactating women are lower, relative to the reference group of women who do not fall to any of these categories. Overall, these results provide evidence that compared to the pregnancy period, the lactating period might be fraught with a more restrictive dietary intake and compromised nutritional outcomes. Kang et al., (2018) posited that this might be because women might be shielded from poor dietary intake due to their intended birth. However, lactating mothers are likely to be treated as non-lactating women irrespective of their nutritional requirements in the lactating period. For instance, evidence shows that women's mean daily consumption of meals including grains is reduced after birth (Kang et al., 2018).

Table 5: Willingness to Pay for Pregnant Women and Lactating Mothers

	(1)		(2)	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Gender				
Female	0.161***	(0.058)		
Pregnancy and Lactating Status				
Pregnant	-0.098*	(0.058)	-0.181***	(0.042)
Lactating / breast-feeding	-0.182***	(0.067)	-0.259***	(0.039)
Age				
30-39	0.090	(0.071)	0.183	(0.113)
40-49	0.142***	(0.029)	0.220**	(0.107)
50-64	0.289***	(0.111)	0.190	(0.185)
> 65	0.119	(0.110)	0.058	(0.169)
Marriage Age (Years)	0.000	(.)	0.000	(.)
5-10	-0.047	(0.073)	-0.063	(0.067)
11-16	-0.051	(0.058)	-0.035	(0.030)
17-22	-0.280***	(0.094)	-0.396***	(0.104)
> 22	-0.336*	(0.179)	-0.128	(0.222)
Household Charateristics:				
Household Size	-0.007	(0.035)	-0.025	(0.027)

Under 5 Years Children	0.000	(.)	0.000	(.)
1	-0.120**	(0.049)	-0.015	(0.018)
2	-0.218***	(0.055)	-0.114	(0.086)
3	-0.052	(0.137)	0.176**	(0.072)
5	-0.809***	(0.111)	-0.650***	(0.147)
Number of Children	0.000	(.)	0.000	(.)
1	0.051**	(0.020)	0.066*	(0.035)
2	0.181***	(0.055)	0.042	(0.092)
3	0.201	(0.137)	0.108	(0.096)
4	0.166*	(0.100)	0.047	(0.143)
5	0.257	(0.173)	0.146	(0.113)
6	0.328	(0.246)	0.227	(0.168)
7	-0.069	(0.259)	0.061	(0.310)
Frequency of Consumption				
Often	0.026	(0.030)	0.010	(0.041)
Sometimes	-0.066*	(0.039)	-0.074	(0.055)
Rarely	0.053	(0.033)	0.124***	(0.047)
Products' Attributes				
Attractive Appearance or Package	0.124**	(0.050)	0.088***	(0.033)
Availability of Nutrition Information	0.099***	(0.022)	0.071***	(0.021)
Nutrition Perception & Consciousness				
Importance of Nutrition Health Importance	-0.273***	(0.040)	0.073	(0.140)
Nutrition Deficiency Consciousness	0.012	(0.008)	0.051	(0.033)
Household Barriers				
Unequal Food Quality in Household	-0.209***	(0.044)	-0.125***	(0.033)
Emotional and Psychological Violence	0.026	(0.127)	-0.242**	(0.113)
Income and Finances				
Intrahousehold Income Gap	0.061	(0.039)	0.190*	(0.114)
Husband Finances	0.097	(0.063)	0.163***	(0.056)
Wife Finances	0.207***	(0.064)	0.187***	(0.070)
Husband and Wife Finance	0.037	(0.026)	0.141***	(0.032)
Intrahousehold Educational Level				
Higher Status by Respondent	-0.014	(0.034)	-0.007	(0.045)
Intrahousehold Employment Status				
Employed Respondent and Unemployed Spouse	0.244***	(0.086)	0.124	(0.105)
Employed Respondent and Spouse	0.177**	(0.086)	0.193**	(0.094)
Occupation				
Farm Activities	-0.202***	(0.051)	-0.370***	(0.085)
Other salary earner (private)	-0.081**	(0.038)	-0.251***	(0.072)
Retailer or market woman/man	-0.135***	(0.050)	-0.282***	(0.081)
Artisan	-0.189***	(0.050)	-0.449***	(0.073)
Intrahousehold Purchase Decisions				
Respondent Only	0.046	(0.127)	0.164*	(0.088)
Respondent's Spouse Only	0.028	(0.162)	0.092	(0.057)
Respondent and Spouse	0.061	(0.130)	0.165**	(0.082)
Knowledge and Awareness:	0.043*	(0.026)	-0.098	(0.063)
Bio(fortified) Food				
Product Effect: Fortified maize	0.113***	(0.032)	0.059	(0.063)
Locality: Urban Areas	0.119***	(0.012)	0.134***	(0.018)
Constant	7.226***	(0.097)	7.260***	(0.205)

Observations	313	174

Note: Reported standard errors are clustered at the province level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4. Monetary Resources and Willingness to Pay of Pregnant and Lactating Women

We had examined the willingness to pay for micronutrient rich food during pregnant and postpartum period focusing on the sample of pregnant and lactating women in our study, with our results revealing that relative to those who are not, pregnant and lactating women have lower wiliness to pay for the bio(fortified) products. While there is the possibility that the pregnant and lactating women might have preference for some other types of food apart from beans and maize flour, particularly in the case of pregnant women who usually have changes in appetite and food aversion during their pregnancy period. However, in our case, a higher share of the sampled women indicated that they always (everyday) or often (three to four days a week) consume the products. This is the case of 84% of the pregnant women and 96% of the lactating mothers as shown in Table A in the appendix which depict their pattern of consumption where many of them rather consume the conventional maize flour or beans with only a few indicating the consumption of fortified maize flour or biofortified beans. Thus, as many of them are frequent consumers of the maize flour and beans, non-frequent consumption of beans and maize flour could not be a plausible explanation for their reduced willingness to pay for the expensive bio(fortified) diets revealed in Table 4.

Given the fact that many of the pregnant and lactating mothers tend to consume the inexpensive and less nutritious conventional maize flour and beans, hence, we thus assess how having intrahousehold bargaining power would affect their willingness to pay for the bio(fortified) products presented to them. This intuition is based on the antecedent evidence which suggests that pregnancy period and the movement from pregnancy period to lactating period is characterised with inhibitive dietary pattern and compromised nutritional outcomes particularly for low-income women (George et al; 2005; Kang et al., 2018). Nevertheless, the possession of higher power dynamics in the household might stimulate them to allocate more monetary resources to the purchase of bio(fortified) nutritious food, which is quite expensive. We proceed by interacting the intrahousehold income gap variable with both the gender dummy variable and the categorical variable capturing whether or not the respondent is pregnant, lactating or otherwise. The results are presented in columns (1) and (2) of Table 5. In column (1), we included this interaction term directly into the regression model and omitted the separate gender dummy. However, in column (2), this interaction term and a separate gender dummy were included in the regression model dummy to enable us to demystify the impacts for men also.

In relation to the estimated results, in column (1), our results revealed that rise in women's intrahousehold income-related bargaining power (such that their income increases relative to their spouses) prompt pregnant women prompt them to want to allocate more income resources for the consumption of the nutritious bio(fortified) products as shown by the positive estimated coefficient on their willingness to pay the bio(fortified) food products. However, the effect is not statistically significant at the conventional level which might indicate that their income level is low or that many of them are in the bottom pyramid of income level. Nonetheless, the previous fall in willingness to pay by the pregnant women revealed in Table 4 has now improved as their income increases more than their spouses. The case of lactating women is somewhat different - a rise in their income relative to their spouses still leave them with a lower willingness with an estimated coefficient of 0.089. Although this is below the reduced willingness to pay of 0.1345 points demonstrated in Table 4 by them. Furthermore, females that are neither pregnant nor lactating seem to have better outcomes, as

their increase in bargaining power leads to an increase in their willingness to buy the bio(fortified) products as shown by their estimated coefficient of 0.229. These results indicate that having a higher bargaining power in relation to income relative to spouse might not necessarily be high enough to improve nutrition in the case of pregnant women and lactating mothers, which could point to a low income. In fact, evidence suggests that the prevalence of poor nutritional intake among pregnant and lactating mothers due to poor income, which is worsened for lactating mothers. This necessitates swift policy responses such as conditional cash or in-kind transfers or policies that boost food and nutrition security among low-income earners.

In the case of Rwanda, significant policy interventions prioritised vulnerable pregnant women and lactating mothers through nutrition education and in-kind transfer of fortified blended food programme – a food supplement intervention or programme for the poor and vulnerable groups including targeted or eligible pregnant women and lactating women and children aged 6 to 23 months so as to improve their nutritional status and reduce stunting in children (Herbert, et al., 2024). There is also the extension of health and nutritional services to them at the village (comprising of 100 to 250 households) level, where three community health workers, *Binomes* who comprise of two persons of both genders and an *Agent de Sante Maternelle* provide a range of services including health and nutrition care training for women, maternal and child health care, among others.

Beside the plausibility of low income, evidence suggests that even pregnant and lactating women might not prioritise their own nutrition in terms of glut or shortage while they use their resources to maximize the welfare of other household members other than their own (Harris-Fry et al., 2017; Kang, et al., 2018). Thus, it is important for the community health workers and other agents to stress the importance of healthy diets during lactation for the mothers and breastfeeding children their nutrition education right from antenatal period and in postnatal health visits. Conditioning in-kind transfer could also propel them to use the transfers judiciously to increase their own and the targeted breastfed children rather than maximizing other non-targeted household members' welfare.

Next, we turn to the estimates in column (2). The results also confirm our basic conclusions that increase in pregnant and lactating mothers' bargaining power in relation to income does not significantly increase their willingness to pay for the former, while the latter still signifies a reduced willingness to pay. In relation to the other group categories, we see that having bargaining power increases the willingness to pay of females that are neither pregnant nor lactating seem, while such the effect of bargaining power is muted for men, which is in line with the proposition that men tend to allocate less resources to food or nutritious food and more resources to capital goods.

Table 6: Intrahousehold Income Gap and Willingness to Pay by Pregnant Women and Lactating Mothers

	(1)		(2)	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Gender				
Female	0.082**	(0.034)	0.089***	(0.033)
Pregnancy and Lactating Status # Intrahousehold Income Gap				
Not Pregnant or Lactating Category:				
Pregnant	0.152	(0.108)	0.156	(0.109)

Lactating	-0.084***	(0.012)	-0.076***	(0.010)
		(0.042)		
Not Pregnant or Lactating Category:				
Female			0.314***	(0.065)
Male			0.043	(0.050)
Age				
30-39	0.086	(0.061)	0.086	(0.056)
40-49	0.152***	(0.042)	0.157***	(0.044)
50-64	0.282**	(0.111)	0.285***	(0.110)
> 65	0.104	(0.123)	0.111	(0.130)
Marriage Age				
5-10	-0.046	(0.064)	-0.046	(0.059)
11-16	-0.062	(0.053)	-0.061	(0.048)
17-22	-0.278***	(0.091)	-0.276***	(0.081)
> 22	-0.348*	(0.185)	-0.358*	(0.187)
Household Size	-0.004	(0.034)	-0.002	(0.035)
Under 5 Years Children				
1	-0.146***	(0.037)	-0.151***	(0.036)
2	-0.278***	(0.073)	-0.281***	(0.075)
3	-0.114	(0.144)	-0.119	(0.143)
5	-0.710***	(0.090)	-0.692***	(0.080)
Number of Children				
1	0.065*	(0.035)	0.069*	(0.035)
2	0.198***	(0.073)	0.198***	(0.075)
3	0.214	(0.154)	0.215	(0.156)
4	0.193	(0.126)	0.192	(0.129)
5	0.261	(0.196)	0.255	(0.193)
6	0.324	(0.275)	0.311	(0.271)
7	-0.047	(0.281)	-0.006	(0.246)
Frequency of Consumption				
Often	0.017	(0.037)	0.015	(0.038)
Sometimes	-0.058	(0.038)	-0.057	(0.038)
Rarely	0.056*	(0.031)	0.052	(0.036)
Products' Attributes				
Attractive Appearance or Package	0.132***	(0.049)	0.138***	(0.050)
Availability of Nutrition Information	0.091***	(0.024)	0.097***	(0.025)
Nutrition Perception & Consciousness				
Importance of Nutrition Health Importance	-0.305***	(0.040)	-0.304***	(0.046)
Nutrition Deficiency Consciousness	0.023	(0.018)	0.028*	(0.016)
Household Barriers				
Unequal Food Quality in Household	-0.189***	(0.042)	-0.207***	(0.038)
Emotional and Psychological Violence	0.024	(0.086)	0.017	(0.085)
Income and Finances				
Husband Finances	0.100*	(0.058)	0.105*	(0.061)
Wife Finances	0.208***	(0.072)	0.200**	(0.080)
Husband and Wife Finance	0.036	(0.026)	0.031	(0.029)
Intrahousehold Educational Level				
Higher Status by Respondent	-0.015	(0.038)	-0.016	(0.040)
Intrahousehold Employment Status				
Employed Respondent and Unemployed Spouse	0.230***	(0.073)	0.224***	(0.064)

Employed Respondent and Spouse	0.178**	(0.071)	0.175***	(0.058)
Occupation	0.000	(.)	0.000	(.)
Farm Activities	-0.199***	(0.039)	-0.203***	(0.035)
Other salary earner (private)	-0.080**	(0.036)	-0.086**	(0.034)
Retailer or market woman/man	-0.133***	(0.038)	-0.136***	(0.034)
Artisan	-0.171***	(0.037)	-0.171***	(0.031)
Intrahousehold Purchase Decisions				
Respondent Only	0.074	(0.147)	0.076	(0.149)
Respondent's Spouse Only	0.073	(0.184)	0.082	(0.184)
Respondent and Spouse	0.096	(0.153)	0.102	(0.152)
Knowledge and Awareness	0.043	(0.035)	0.043	(0.036)
Bio(fortified) Food				
Product Effect: Fortified maize	0.126***	(0.034)	0.129***	(0.036)
Locality: Urban Areas	0.120***	(0.016)	0.128***	(0.019)
Fixed Effects				
Product	Yes		Yes	
District	Yes		Yes	
Province	Yes		Yes	
Locality	Yes		Yes	
Constant	7.188***	(0.115)	7.192***	(0.119)
Observations	**313**		**313**	

Note: Reported standard errors are clustered at the province level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.5. Living Wage and Willingness to Pay of Pregnant Women and Lactating Mothers

Income or economic empowerment has been advocated as a viable avenue to increase women's bargaining power and ensure more nutritious outcomes. However, not earning enough might not give or increase their bargaining power particularly if they are in the bottom income pyramid. While Rwanda does not currently have a minimum wage, it however has an approved living wage which was estimated at 174,290 Rwf (). Having a living wage is important for families to ensure their food security and nutritious outcome, and being below such living wage cutoff might likely explain their fall in or insignificant willingness to pay for the bio(fortified) food products. In fact, an exploratory examination of our data reveals that about % of pregnant women and lactating mothers do not meet this minimum living wage as indicated by their estimated monthly income. Thus, we further investigate how earning a decent wage in the form of living wage could affect the willingness to pay for pregnant women and lactating mothers. We do so by creating three distinct variables which are thereafter interacted with the gender and multichotomous variable capturing whether or not the respondent is pregnant, lactating or otherwise. These three variables are a dummy variable which assumes the value of one when the respondent earns a living wage, while the spouse may or may not earn a living wage; a intrahousehold dummy variable which assumes the value of one when only the respondent's spouse earns a living wage, but the respondent does not; an intrahousehold dummy variable which assumes the value of one when only the respondent earns a living wage, but the spouse does not.

The results of this are presented in Table 7 below. In column (1) our results show respondents – pregnant, lactating and males – who do not earn a decent wage or living wage have reduced willingness to pay. However, with the distinction of income as living wage or otherwise, our results finds that respondents (pregnant, lactating and other females who are neither pregnant nor lactating) with living wage pregnant demonstrated increased willingness to pay, with the income effect now larger for lactating mothers while living wage pregnant women also

demonstrated a significant rise in their willingness to pay. These results in relation to those obtained in Table 4 implies that relatively higher income relative to their spouses do not necessarily give women higher bargaining power to allocate resources for the purchase of the bio(fortified) food products. Instead, having a living wage irrespective of whether their spouse also earns such a living wage is the "glass ceiling breaker" and a viable avenue to increasing their bargaining power and ensure they increase their allocation of their monetary resources for the purchase of the nutritious bio(fortified) food products. This result supports the International Labour Organisation (ILO) proposition that having decent work or earnings can serve as means to eradicate poverty and ensure food security (ILO, n.d).

The higher association between living wage and willingness to pay in our study suggest the need to scale up maternal and child nutrition interventions through further investments in measures that can strengthen food and nutritional security and accelerate poverty reduction which could entail nutrition-sensitive social protection programmes that extend food supplemented food products to other food varieties in addition to ones presently observed in the country.

Table 7: Decent Wage and Willingness to Pay in Pregnant Women and Lactating Mothers

	(1)	
	Coef.	**S.E.**
Age		
30-39	0.081	(0.061)
40-49	0.129***	(0.021)
50-64	0.330***	(0.067)
> 65	0.184**	(0.085)
Marriage Age (Years)		
5-10	-0.043	(0.047)
11-16	-0.032	(0.026)
17-22	-0.279***	(0.059)
> 22	-0.342***	(0.121)
Household Size	-0.019	(0.027)
Under 5 Years Children		
1	-0.105***	(0.034)
2	-0.139***	(0.032)
3	0.046	(0.114)
5	-0.697***	(0.096)
Number of Children		
0	-0.013	(0.199)
1	0.052	(0.176)
2	0.153	(0.164)
3	0.167	(0.134)
4	0.140	(0.140)
5	0.247	(0.153)
6	0.320*	(0.167)
Frequency of Consumption		
Often	0.033	(0.022)
Sometimes	-0.091***	(0.019)
Rarely	0.089**	(0.037)
Products' Attributes		

Attractive Appearance or Package	0.095**	(0.040)
Availability of Nutrition Information	0.090***	(0.008)
Nutrition Perception & Consciousness		
Importance of Nutrition Health Importance	-0.239***	(0.059)
Nutrition Deficiency Consciousness	0.004	(0.004)
Household Barriers		
Unequal Food Quality in Household	-0.171***	(0.038)
Emotional and Psychological Violence	0.003	(0.130)
Pregnancy and Lactating Status # Intrahousehold Decent Income Status		
Has No Decent Income:		
Pregnant	-0.147**	(0.068)
Lactating	-0.233***	(0.075)
Male	-0.262***	(0.082)
Has Decent Income:		
Pregnant	0.075**	(0.029)
Lactating	0.170***	(0.046)
Female, not Pregnant nor Lactating	0.147***	(0.006)
Income and Finances		
Husband Finances	0.099**	(0.043)
Wife Finances	0.135**	(0.061)
Husband and Wife Finance	0.034***	(0.010)
Intrahousehold Educational Level		
Higher Status by Respondent	0.014	(0.027)
Intrahousehold Employment Status		
Employed Respondent and Unemployed Spouse	0.114	(0.077)
Employed Respondent and Spouse	0.083	(0.064)
Occupation	0.000	(.)
Farm Activities	-0.117***	(0.038)
Other salary earner (private)	-0.019	(0.033)
Retailer or market woman/man	-0.097	(0.062)
Artisan	-0.090**	(0.040)
Intrahousehold Purchase Decisions	0.000	(.)
Respondent Only	-0.062	(0.122)
Respondent's Spouse Only	-0.031	(0.152)
Respondent and Spouse	-0.025	(0.130)
Knowledge and Awareness:	0.005	(0.030)
Bio(fortified) Food		
Product Effect: Fortified maize	0.095***	(0.029)
Locality: Urban Areas	0.079***	(0.015)
Constant	7.467***	(0.070)
Fixed Effects		
Product	Yes	
District	Yes	
Province	Yes	
Locality	Yes	
Observations	**319**	

Note: Reported standard errors are clustered at the province level. Clustered robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.0. Conclusion and Policy Recommendation

This study investigates how intrahousehold power dynamics affect their willingness to want to allocate resources and purchase fortified maize flour and biofortified beans which are relatively more expensive than the conventional non-fortified maize flour and beans in informal settlements in Rwanda. It assesses consumers' perception and their valuation of fortified maize flour and biofortified beans at the household level. It also examines how increased intrahousehold power dynamics in relation to income influence mothers' and fathers' willingness to allocate income to purchase the (bio)fortified products for their under-five aged children. Furthermore, it investigates the consumption behaviour of pregnant women and lactating mothers, majority of whom are presently consuming conventional unfortified maize flour and beans, in terms of their willingness to pay for the (bio)fortified versions of these products, and how increased monetary bargaining power relative to their spouses and access to decent or living wages influences their inclination to pay for such products.

In general, we find evidence that intrahousehold power dynamics exert influences but not always on the willingness to allocate resources to purchase the (bio)fortified food products. Women with higher economic resources and food purchase decision makers in their households exert more bargaining power and influence over decisions and willingness to pay for the (bio)fortified food. In addition, having higher education or employment status than their spouses do not necessarily give them more bargaining power or influence their willingness to purchase the (bio)fortified food products. However, men usually reveal a disconnection between nutrition and masculinity as they are less willing to pay for the (bio)fortified products, even when they have higher economic resources than their spouses, or when they are the sole food purchase decision makers. Nonetheless, they exert more bargaining power and influence when they are employed, and their spouses are not. Also, we find evidence that a rise in women's intrahousehold income-related bargaining power relative to their spouse increases their willingness to pay for the nutritious bio(fortified) food, with their willingness to pay increasing with their number of children. In contrast, men tend to allocate monetary resources away from their under-five aged children irrespective of their possession of intrahousehold bargaining income power. These results highlight the need to increase the bargaining power of women as a prominent means for improving children's nutrition and other welfare, which need to reflect in policy designs.

Our results point to a gross dissonance between masculinity and nutrition as reflected by men's unwillingness to pay for the bio(fortified) food product irrespective of when they possess high intrahousehold bargaining power. While Rwanda has one of the highest elected women decision makers in the parliament, the existing gender norms assume men as the main decision makers or at the forefront of intrahousehold decision making including those on nutrition without their possession of sufficient nutrition education or knowledge, which led to less favourable household purchase outcomes as shown by our results. These results indicate the importance of tailored nutrition interventions and education which target men along with their spouses. Due to the perception that women are in charge of food preparation, many nutritional interventions are geared towards women and child welfare and nutritional education, with men left behind, causing them to continue spearheading and making uninformed and haphazard household nutrition decisions and outcomes without nutritional knowledge. Thus, we advocate for high-level men representation and their active involvement in local and community nutrition education interventions with the aim of bridging men's nutrition knowledge gaps to enable them to make informed decisions and

increase their contribution to household nutrition and nutritional outcomes as crucial household members.

Besides, bridging the information gap would also involve the government stepping up on its sensitization campaign about the (bio)fortified food beyond the digital mass media. Many of this study participants are aware of the existence of the (bio)fortified food products but cannot proactively relate to their importance nor differentiate them from the conventional ones in the markets during purchase activities. Providing consumer information in a more user-friendly format would enable nutrition information to be quickly demystified by uneducated or less educated populace. In addition, labelling requirements on the bio(fortified) products are imperative to ensure product differentiation and better portray the nutrition benefits of (bio)fortified products over their conventional counterparts.

Further evidence shows heterogeneous behaviour among women, with pregnant women having low willingness to purchase the (bio)fortified products, while lactating mothers showed an even lower willingness to pay for the products. Increases in their income bargaining power relative to their spouses was not able to significantly reverse their low or unwillingness to pay, except for those who earn a living wage or decent income. Developing strategic economic policies to combat socioeconomic inequalities in nutritional intakes must be implemented to prevent a nutrition divide among women with low-income or those who are in the bottom of the income pyramid. Poor income can escalate poor dietary intake, worsen household food and nutrition security particularly among low-income group. Ensuring better nutritional outcomes among pregnant women and lactating mothers would thus entail a blend of economic and nutrition policies that increases the affordability and acceptability of nutritious food such as the (bio)fortified food considered in this study. First, in relation to its economic policies, it is imperative for the government to facilitate the decency of work by ensuring workers earn decent or living wages so as to ensure productivity and strengthen economic access and affordability of nutritious food. The Umurengen Programme (VUP) in Rwanda already provide support to labour constrained and very poor household which can improve their access to food via income generation. It is thus imperative for such employment expansionary policies to be characterised by work that foster adequate earning and productive work as this is central to ILO's Decent Work Agenda.

Second, nutrition-wise, the Rwanda government supports consumption interventions through in-kind transfer of fortified products for pregnant and nursing mothers. This includes the provision of fortified flour products such as *Shisha Kibondo* and *Sosoma fortified* as proactive steps to prevent stunting in children aged 6 to 59 months. However, the issue of their affordability needs to be holistically tackled due to the pricy nature of (bio)fortified food products. Interventions aimed at increasing affordability and accessibility to others (young mothers and other women of childbearing age, children) categories are also important which might be dicey in the face of budget constraints. Other viable avenues are subsidizing their production at the farmers' level to enable price fall, ensuring price reduction through interventions such as government commodity or agricultural marketing boards. Thus, interventions to improve the food environment through the reduction in unequal food outcomes must ensure government food and nutrition policies align well with its economic and agricultural production.

Rwanda has achieved very high gender representation of women in decision making at the public sphere through gender affirmative actions. Such efforts must be intensified and extended to the social sphere to break the glass ceilings that the existing gender norms and

restrictive cultural norms exert on nutrition, to ensure improved nutrition outcomes at the household and community spheres. Gender roles and local construction of masculinity and femininity play important roles in household's food purchase and nutrition decisions. It is thus imperative for policy designs, interventions and advocacies to consider men in gender and nutrition intervention programmes by actively involving them in such interventions to help in reshaping or eliminating patriarch and discriminating gender norms while allowing the evolution of better societal norms that can better promote household nutrition security and outcomes. This will enable them to question and do away with discriminating gender norms that disadvantage women or disfavourably privilege men over women and allow for the evolution of better societal norms.

In the personal food domain, entrenched discriminatory gender norms that are in disconnection with improved household nutritional outcomes or those that worsen gender inequality are systemic and might be difficult to change. At the institutional level, competent authorities must work with community leaders to gradually reshape the norms through long-term strategic education, participatory learning and actions. Rwanda authorities provide such services to villages through various programmes involving community health workers, *Agent de Sante Maternelle*, and *Binômes* at the village level, who provide a range of services including health and nutrition care training for women, maternal and child health care, among others. It is imperative to also actively engage community leaders in lending their voices to ensure a positive behavioural change that could shield away restrictive and discriminatory gender norms that create dissonance between masculinities and nutrition at the household level. This could be institutionalised in nation-wide homegrown government initiatives such as Rwanda's *Ubudehe* policy programme where socio-economic problems are solved through cultural value of mutual assistance and participatory mechanisms.

Conclusively, addressing these underlying factors particularly indecent income, and gender norms and masculinities that promote unequal food consumption and unwillingness of men to purchase micronutrient enhanced food can help water-down the epidemic of household inequalities and ensure a more healthier food environment both in the public and personal food domains.

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