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RESEARCH ARTICLE

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Dietary Diversity among Tanzanian Women: Insights from National Panel Survey Wave 4 Data

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ABSTRACT

Tanzania's national surveys offer potential for calculating Minimum Dietary Diversity for Women (MDD-W), a key health indicator. However, apart from the 2022 Tanzania Demographic and Health Survey (TDHS), most surveys lack the necessary data variables for MDD-W trend analysis, leaving national trends unreported for nearly two decades. This study used National Panel Survey Wave 4 (NPS4) data to estimate a proxy MDD-W value for 2014/2015, comparing it with TDHS 2022 findings. The 2014 data was selected due to its 8-year interval, a reasonable timeframe to assess changes. Sixty food items were categorized into 10 groups (FAO, 2021), focusing on women aged 15–49. Data were linked using unique identifiers to household food consumption records. Grains, roots, and tubers were consumed by 56.62%, while only 19.3% ate meat, poultry, or fish. Other food groups had under 3% consumption. Slightly more than half (57%) of women consumed at least two food groups and only 8% consuming 5 or more food groups. This analysis reveals alarmingly low and stagnant dietary diversity among Tanzanian women of reproductive age. With a consistent MDD-W of 8% from 2014/15 to 2022, progress has stalled. Diets remain overly dependent on staples and lack vital, nutrient-rich foods.

Keywords: Micronutrients, women of reproductive age, minimum dietary diversity, health outcomes, Tanzania.

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INTRODUCTION

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) is a widely recognized public health indicator. It reflects micronutrient adequacy in women, a group with increased nutritional needs due to physiological demands such as pregnancy and lactation (Adubra et al., 2019; Dereck et al., 2024). The Food and Agriculture Organization (FAO) defines MDD-W as the proportion of women aged 15–49 who have consumed food from at least five out of ten defined food groups in the previous 24 hours. High prevalence of MDD-W within a population indicates better nutritional status and improved health outcomes (Bellows et al., 2020).

Beyond health, MDD-W carries significant socioeconomic implications. Women's nutrition influences national productivity, maternal and child health, and long-term development outcomes. For example, anemia alone costs Tanzania approximately 1.5% of its GDP annually (World Bank, 2023). Comparable economic losses are reported in Ethiopia and India due to undernutrition and maternal/child malnutrition, respectively (National Nutrition Program, 2013; Government of India, 2018). The Copenhagen Consensus estimates a return on investment of up to $16 per $1 spent on improving nutrition. Thus, addressing poor dietary diversity is both a health and economic imperative for Tanzania. Despite its importance, MDD-W has not been consistently monitored in Tanzania. Over the past two decades, national surveys have rarely included the necessary variables to compute MDD-W, with the notable exception of the Tanzania Demographic Health Survey and Malaria Indicator (TDHSMIS) 2022. As a result, national trends in women's dietary diversity have remained largely undocumented. The lack of routine data hinders policy planning and targeted interventions.

Monitoring MDD-W trends enables policymakers to better understand the socioeconomic drivers and consequences of women's nutritional status. This study uses data from the Tanzania National Panel Survey Wave 4 (NPS4, 2014/15) to estimate a proxy MDD-W value for that period. The 8-year interval between NPS4 and TDHS 2022 provides a reasonable time frame to assess changes in dietary diversity. This analysis aims to inform future monitoring frameworks and guide nutrition-sensitive policy and programming in Tanzania.

METHODS

Study Design

This study employed a secondary analysis of a nationally representative, repeated cross-sectional survey, the Tanzania National Panel Survey (NPS) 2014–2015 Wave 4. The NPS4 employed a stratified, two-stage cluster sampling design to collect data on socio-economic characteristics, agricultural production, and food consumption, following the same households over time to monitor living conditions. The dataset is publicly accessible via the World Bank Microdata Library (World Bank, 2023). Study design, sampling framework, and data collection procedures for NPS4 are detailed in the technical report published by the Tanzania National Bureau of Statistics (National Bureau of Statistics, 2017).

Study Location

Data were derived from a nationally representative, population-based survey conducted across the United Republic of Tanzania. The complex survey design permits the extrapolation of estimates to the national level. The study area, depicted in appendix 1, is divided into a stratified layout consisting of Tanzania Mainland (encompassing Dar es Salaam), Other Urban centers, Rural zones, and Zanzibar.

Study Population

The study population for this analysis consisted of women of reproductive age (WRA), defined as female members of surveyed households aged 15 to 49 years. This demographic is a key priority in public health nutrition due to their heightened nutritional requirements and pivotal role in maternal and child health outcomes.

Sample size determination

Since this study is a secondary analysis of an existing dataset, the sample size was predetermined by the Tanzania National Panel Survey (NPS4). Consequently, a power calculation was not conducted post hoc, and the analytical sample comprises all eligible cases from the source dataset that met the inclusion criteria for this investigation.

Inclusion Criteria

The analysis included female household members aged 15–49 years, corresponding to the standard definition of women of reproductive age (WRA). Only women who had a "yes" response to the consumption of at least one of the listed food items were selected. This age group represents women of reproductive age, a population group prioritized in nutrition research due to their increased nutritional needs and critical role in maternal and child health. Following FAO guidelines (FAO, 2021), the 60 food items were grouped into the following 10 standard food groups for MDD-W computation: 1. Grains, white roots, and tubers; 2. Pulses (beans, peas, lentils); 3. Nuts and seeds; 4. Dairy products;5.

Meat, poultry, and fish; 6. Eggs; 7. Dark; green leafy vegetables; 8. Vitamin A-rich fruits and vegetables; 9. Other vegetables and 10.Other fruits.

Sampling technique

The sampling technique is inherited from the primary study. This secondary analysis uses the pre-existing, nationally representative sample generated by the NPS4.

Data collection tools

The data collection tools for this analysis were those implemented in the primary Tanzania National Panel Survey (NPS4). These included structured household and agricultural questionnaires with a specific food consumption module, which captured the dietary data used in this study. No new data collection instruments were deployed.

Data collection procedure

All analyses were conducted using STATA version 15.0. The 60 food items were reclassified into the 10 FAO-recommended food groups. Binary logistic regression was used to assess association between MDD-W (≥5 food groups: 1 for Yes and 2 for No) and demographic predictors. Descriptive statistics were used to estimate the proportion of women meeting the MDD-W threshold. The MDD-W index was then analyzed as a dependent variable, with selected socio-demographic factors (e.g., age, education, residence, and household wealth) as explanatory variables. Logistic regression was performed to assess associations between MDD-W and thesefactors. Results were presented in tables, and descriptive narration was developed using Microsoft Word. Key assumptions included that women accurately recall all foods and beverages consumed during the reference (7 days) period, and that all food items are correctly classified into one of the ten FAO-defined food groups, that a food group to count toward the MDD-W score, it is assumed that at least 15 grams of food from that group were consumed on a given week, based on either direct reporting or reliable estimation, and that mixed dishes are properly disaggregated to assess individual ingredients. When analyzing survey data, it is also assumed that the sample design is appropriately accounted for using design-adjusted methods to produce representative and unbiased estimates.

MDD-W Computation

The FAO defines MDD-W as the proportion of women who consumed foods from at least five of the ten specified food groups in the previous 24 hours, reflecting a minimum level of dietary diversity associated with higher micronutrient adequacy (FAO, 2021). However, the NPS4 dataset collected 7-day recall data rather than 24-hour dietary recall. A 7-day recall was used, for which the food group was counted as consumed if the woman ate at least 15g on any one of the seven days. The MDD-W thus is the proportion of women meeting the threshold of having ate at least 5 of the food groups or more. To approximate the MDD-W from this dataset, a food group was considered "consumed" if the respondent reported eating at least one item from the group within the 7-day reference period. This approach has been used in similar secondary analyses to generate proxy MDD-W scores in the absence of 24-hour recall data. While not equivalent to the gold-standard method, it allows for indicative comparisons and policy insights, especially in data-limited settings. This approach captures habitual dietary patterns and reduces short-term variability. It is a practical adaptation of the FAO's MDD-W method, especially useful in low-resource settings where daily recall is challenging. Scoring any consumption within the week helps minimize recall bias and reflects dietary diversity without requiring frequency or quantity data. As the MDD-W aims to measure variety rather than adequacy, this method offers a conservative yet inclusive assessment of women's dietary diversity.

Ethical Considerations

This study is a secondary analysis of the Tanzania National Panel Survey (NPS) wave 4. The ethical oversight for the original survey was the responsibility of the National Bureau of Statistics (NBS) of Tanzania and the World Bank's Living Standards Measurement Study (LSMS) team, who ensured informed consent and ethical data collection. The anonymized dataset was accessed and used in accordance with the terms and conditions of the World Bank Microdata Library. No individual ethical approval number was required for this analysis as it uses existing, de-identified public data. All necessary measures were taken to maintain data security and respondent confidentiality.

Limitations

The use of 7-day recall to estimate 24-hour indicator, time lag between 2014 NPS4 and 2022 TDHSMIS, lack of control over variables included in secondary dataset and lack of consumption quantities and intra-household food distribution may have introduced limitations in this analysis.

RESULTS

Demographic and Socio-Economic Characteristics of Study Participants

Table 1a summarizes the study participants' demographic and socio-economic profile. The analysis included 3,884 women of reproductive age (WRA). The largest age cohort was 20-35 years, comprising 2106 (54%) of the participants within the 15-49-year range. A significant majority 3251(84%) of the women had attended school, with primary education being the most common level 1940 (72%). Swahili was the predominant native language, reported by 2108(54%) of respondents.

Table 1a:

Social-Demographic Characteristics of Respondents

Characteristics	Observation	%	Cum
Age			
15-19	813	20.93	20.93
20-35	2106	54.22	75.15
36-49	965	24.85	100
Employment			
Employed	2128	54.94	54.94
Not Employed	1745	45.06	100
Ever go to School			
Yes	3251	83.94	83.94
No	622	16.06	100
Read and write			
Swahili	2108	54.43	54.43
English	48	1.24	55.67
Kiswahili And English	912	23.55	79.22
Other	1	0.03	79.24
No	804	20.76	100
Education Level			
Primary Level	1940	70.91	70.91
Secondary Level	764	27.92	98.83
Higher Education	32	1.17	100
Marital Status			
Married	2230	57.58	57.58
Not Married	1643	42.42	100
Residence			
Rural	1984	59.19	59.19
Urban	1368	40.81	100

Source: *output of the analysis*

Minimum Dietary Diversity for Women by Age Group

Table 1b summarizes the Minimum Dietary Diversity for Women (MDD-W) by age group. Overall, only 8% (95% CI: 0.07, 0.08) of women met the MDD-W requirement by consuming items from at least five of the ten food groups. Dietary consumption patterns were similar across all age groups. Among the women who achieved MDD-W, the 20-35-year-old cohort was the most represented, constituting 1,941(54%) of this subgroup.

Table 1b:

Minimum Dietary Diversity of women by age group (yes >=5 food groups)

Age	No MDDW (frequency)	%	Yes, MDDW (Frequency)	%	Total Frequency	%
15-19	751	21	62	20	813	21
20-35	1,941	54	165	54	2,106	54
36-49	886	25	79	26	965	25
Total	**3,578 (92%)**	**100**	**306 (8%)**	**100**	**3884**	**100**

Source: *output of the analysis*

Food Groups Consumption by Age Categories

Table 1c shows food groups consumed by age categories. Of the food categories, grain, root and tubers as well as pulses had the most 1,941 (57%) and least 45 (1.83%) proportion of consumption respectively. There was a higher proportion of women in the age group of 15-19 consuming milk and milk products than in other age categories (p value < 0.05) and no other food category had variation in consumption by age factor.

Table 1c:
Food groups consumed by age groups

Age group		*FOODS GROUPS*										
		Grain, roots, tubers	**Pulses**	**Nuts and Seeds**	**Milk and milk products**	**Meat, Poultry, fish**	**Eggs**	**Dark green leafy vegetables**	**Vit A rich fruits and vegetables**	**Other Vegetables**	**Other Fruits**	**Total**
15–19	*f*	280	4	24	36	89	*14*	*14*	9	*10*	*14*	494
	%	56.68	0.81	4.86	7.29	18.02	*2.83*	*2.83*	*1.82*	*2.02*	*2.83*	*100*
20–35	*f*	765	28	75	59	262	*23*	*33*	*38*	*33*	*32*	*1348*
	%	*56.75*	*2.08*	5.56	4.38	19.44	1.71	2.45	*2.82*	*2.45*	*2.377*	100
36–49	*f*	*345*	13	29	30	123	17	*16*	18	*9*	*13*	613
	%	*56,28*	*2.12*	*4.73*	*4.89*	*20.07*	*2.77*	*2.61*	*2.94*	*1.47*	*2.12*	*100*
Total	*f*	*1390*	*45*	*128*	125	*474*	*54*	*63*	*65*	*52*	*59*	*2455*
	%	*56.62*	*1.83*	*5.21*	5.09	*19.31*	*2.20*	*2.57*	*2.65*	*2.12*	*2.40*	*100*
T-Test	**p-value**	*0.884*	*0.029*	0.447	0.045	*0.708*	*0.420*	*0785*	*0.530*	*0.532*	*0.670*	

***Source**: output of analysis*

Table 2 presents the results of the univariate analyses for the Minimum Dietary Diversity for Women (MDD-W). The analysis found no statistical significance association between MDD-W and the independent variables: age, employment status, education level, marital status, and residence.

Table 3:

Dissolution Profiles of the Sampled ABZ Brands After 30 Minutes

MDDW	Odds ratio	Std. Error	Z	p> |z|	95% interval
Age	1.0533460	0.0506395	1.08	0.28	*0.9586272 - 1.157424*
Employment	0.9693729	0.0633266	-0.48	0.63	*0.8528725 - 1.101787*
Education Level	0.8843629	0.0703713	-1.54	0.12	*0.7566551 - 1.033625*
Marital Status	0.9109075	0.0598740	-1.42	0.16	*0.8008014 - 1.036153*
Residence	0.9315492	0.1309708	-0.50	0.61	*0.7071824 - 1.227100*

Source: output of the analysis ***MDDW** = Minimum Dietary Diversity of Women

Minimum Dietary Diversity for Women in Tanzania

Table 2 presents the results of the univariate analyses for the Minimum Dietary Diversity for Women (MDD-W). The analysis found no statistical significance association between MDD-W and the independent variables: age, employment status, education level, marital status, and residence.

Table 3:

Dissolution Profiles of the Sampled ABZ Brands After 30 Minutes

MDDW	Odds ratio	Std. Error	Z	p> |z|	95% interval
Age					
20-35	0.0286213	0.0615611	0.46	0.64	*-0.0922664*
36-49	0.0105102	0.0686817	0.15	0.88	*-0.1243602*
Employment					
Not Employed	0.0062837	0.0397233	0.16	0.88	*-0.071721*
Residence					
Urban	-0.0187071	0.039999	-0.47	0.64	*-0.092848*
Marital Status					

Not married	-0.0103697	0.0420015	-0.25	0.81	*-0.092848*
Education Level					
Secondary Level	0.0558447	0.0439315	1.27	0.20	*-0.0304237*
Higher Education	-0.4097104	0.2034123	-2.01	<0.05	*-0.8091513*
_Cons	0.5610483	0.0673988	8.32	0.000	*0.4286971*

Source: *Output of the analysis*

DISCUSSION

Existing literature frames maternal education as a key determinant leading to improved MDD-W, a link supported by high prevalence rates (Abel & Abebaw, 2021; Saaka et al., 2021) and significant odds ratios (Niguse, Dessalegn, & Tefera, 2021). In contrast, the present study identifies a reciprocal association, suggesting that the relationship between education and dietary diversity is bidirectional. The critical context for this finding is the low overall MDD-W prevalence of 8% in our sample. This indicates that the reciprocal dynamic is occurring in an environment where nutritional resources are scarce, as represented by the Tanzania Demographic Health Survey and Malaria Indicator Survey (TDHSMIS 2022) which reported anemia in 42% of women of reproductive age and only one quarter (25%) of women of reproductive age attained MDD-W. This scarcity is further evidenced locally by carbohydrate consumption by 57% from grains/roots across all age groups. Although adolescents showed relatively higher dairy intake, the prevalent grain/root reliance confirms iron, zinc, folate, and vitamin B_{12} deficiencies. These findings demand urgent multi-sectoral policy actions. For Tanzania, this includes: (1) fortifying staple flours with iron, zinc, folate, and vitamin B_{12} to directly address prevalent micronutrient deficiencies; (2) integrating nutrition-specific education focused on dietary diversification beyond grains into school curricula and women's empowerment programs to leverage the reciprocal education-nutrition relationship; and (3) promoting and subsidizing the production and consumption of diverse, nutrient-dense foods like pulses, vegetables, and animal-source foods through agricultural extension and market incentives. Globally, this study underscores that education alone is insufficient amidst food system constraints. International actors and donors should: (1) prioritize and fund food system interventions that enhance the availability and affordability of diverse foods, rather than focusing solely on calorie sufficiency; and (2) support national fortification programs as a cost-effective strategy to improve micronutrient status in high-risk populations, thereby contributing to the global fight against hidden hunger.

Conclusions

While only 8% of women met the MDD-W threshold in 2014, this study confirms a reciprocal association between education level and MDD-W scores. The relationship is constrained by scarce nutritional resources as evidenced by such a low MDD-W prevalence. This is explained by prevalent grain/root reliance, with 57% of carbohydrate consumption from these sources across all age groups, confirming iron, zinc, folate, and vitamin B_{12} deficiencies. Therefore, the analysis reveals alarmingly low and stagnant dietary diversity among Tanzanian women of reproductive age. With a consistent MDD-W of 8% from 2014/15 to 2022, progress has stalled. Diets remain overly dependent on staples and lack vital, nutrient-rich foods.

Recommendations

Based on the findings of low and stagnant dietary diversity among Tanzanian women, despite general food availability, a multi-sectoral policy response is calm. The persistent 8% MDD-W rate and over-reliance on staples indicate that food security has not translated into nutrition security. Economic and social protection policies must ensure women can access available nutritious foods. This requires implementing direct to women nutrition incentive programs, such as vouchers for pulses and eggs, to empower personal food choices and overcome intra household allocation biases that favor staples. A robust national social and behavior change

SBC) campaign is needed to shift deep seated food preferences. Mass media and community channels should promote specific, actionable messages linking diverse diets to maternal health and child development, making nutrient consumption a social norm. Parallel, agricultural and food system policies must hinge from calorie sufficiency to nutrient density. This involves strengthening value chains for convenient, fortified foods and supporting SMEs to produce affordable, nutrient rich products, making the healthiest choices the easiest ones. Mainstreaming MDD-W as a key national performance indicator will ensure accountability across ministries, driving coordinated action to transform national food abundance into improved nutritional well-being for every woman.

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Authors' Contributions

AZS, ORM and JJM conceptualized the study and handled data collection, cleaning was performed by AZS, JK and ORM. AZS, JK and ORM analyzed the data. AZS wrote the first draft of the manuscript and all authors provided creative inputs during manuscript drafting and revisions. All authors read and approved the final manuscript.

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