ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 23 No. 5
May 2023
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2023; 23(5): 23406-23424 https://doi.org/10.18697/ajfand.120.22600

DIETARY DIVERSITY AND MICRONUTRIENT RICH FOOD CONSUMPTION PATTERNS AMONG WOMEN OF REPRODUCTIVE AGE IN KAYUNGA AND JINJA, UGANDA

Nabakabya D[1], Fungo R[1,2]*, Tumwine G[1,3], Muyonga JH[1], Kaaya AN[1], Keding GB[4] and J Sarfo[4]

Robert Fungo

*Corresponding author email: rfungom@yahoo.com

[1]Department of Food Technology and Nutrition, Makerere University, Uganda

[2]Mountains of the Moon University

[3]International Center for Tropical Agriculture (CIAT), P. O. Box 6247, Kampala, Uganda

[4]Division Quality of Plant Products, Department of Crop Sciences, University of Goettingen, Goettingen, Germany

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 23 No. 5
May 2023
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

The diets of women of reproductive age (WRA) in low-income countries have been reported to be inadequate in micronutrients which lead to undernutrition. The foods commonly consumed by women are usually starchy plant-based cereals, roots and tubers which are limited in micronutrients. Amidst Uganda producing abundance of fruits and vegetables which are sources of micronutrients, it seems that consumption patterns have a role to play. The aim of this study was, therefore, to evaluate the prevailing diets of women of reproductive age in Kayunga and Jinja districts. A cross- sectional study was conducted in August 2019. Four hundred and ninety two (492) women of reproductive age were purposively selected from the two sub-counties to participate in the study. A 24-hour recall questionnaire was used estimate the women's minimum dietary diversity for women of reproductive age (MDD-W) and it is contribution towards meeting micronutrient requirements. Means were computed for continuous variables, while proportions were computed for the descriptive variables that were placed under different themes and categories. Results revealed that more than 80% of women did not achieve the minimum dietary diversity. Less than 50% of the women consumed foods from plant and animal protein rich food groups that are major sources of iron, zinc, calcium, and vitamin B-12. In addition, more than 80% of the women's diets lacked vitamin A- rich fruits and vegetables and dark green leafy vegetables which are the rich food group sources for vitamin A and folate. Therefore, over 80% of the women in Kayunga and Jinja districts did not obtain the required micronutrients for their good health and that of their children and thus, are at risk of poor health due to micronutrient deficiencies. It is recommended to have nutrition education coupled with demonstrations to mothers on how to prepare a diversified diet.

Key words: Women, dietary diversity, food groups, micronutrients, nutrient adequacy

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

INTRODUCTION

Women of reproductive age (WRA) are often nutritionally vulnerable because of the physiological demands of pregnancy and lactation [1]. Poor nutritional status weakens a woman's ability to survive childbirth, makes her more susceptible to infections, and undermines her productivity and ability to care for her children [2]. Inadequate nutrient intake before, during pregnancy and lactation affects women as well as their infants. Inadequate nutrient intake can cause anaemia, pre-eclampsia, haemorrhage and death in mothers [2, 3]. They can also lead to stillbirth, low birth weight, wasting and developmental delays for children [2, 3]. Therefore, adequate macronutrients and micronutrients in the diets are critical for women's health during reproductive years. The micronutrients of concern that are frequently deficient in the diets of women in low-income countries are; calcium, iron, folate, zinc, thiamine, riboflavin and vitamins A, D, B-6, and B-12 [3]. In Uganda, the most common micronutrient deficiency in women of reproductive age is anaemia with a national prevalence of 32%, then 41.1% and 31.6% in Jinja and Kayunga districts, respectively [4]. On the other hand, Vitamin A deficiency is also quite high at 36% [5]. The common cause of micronutrient deficiencies among Ugandan women of reproductive age is inadequate diets that are deficient in essential micronutrients [4].

Women of reproductive age constitute one vulnerable group in resource-poor environments such as Uganda, where low quality monotonous diets are the norm [6]. These diets are dominated by grain or tuber-based staples. These diets lack vegetables, fruits and animal source foods, leading to a high risk of micronutrient deficiencies among the consumers [7]. Fruits and vegetables are relatively cheap sources of essential micronutrients compared to animal source foods, because they provide a cost-effective strategy to prevent micronutrient deficiencies, if consumed in adequate amounts in the developing countries [8]. High-quality diets are characterised by offering balance in intake of proteins, carbohydrates and fat, as well as moderation in the consumption of foods low in nutrient density and those associated with increased risks for chronic diseases [1]. The demographic health survey report of Uganda, reveals that the most frequently consumed food groups in Uganda are roots and tubers, cereals oils and fats [6]. The report [6] further indicates that food groups including vegetables, fruits, nuts and legumes, meat, poultry, fish, and dairy products, are the least consumed in Uganda.

There are efforts to improve micronutrient intake by promoting consumption of fortified foods, balanced diets as well as taking micronutrient supplements. However, with these efforts, the micronutrient deficiencies among WRA are still

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

high in Uganda. This has been a result of lack of effective platforms and programmes reaching adolescent girls and WRA outside the prenatal care and inadequate programmatic action to improve women's diet quality and nutrition [1]. Despite Uganda's high food production and abundance of fruits and vegetables, family diets are reportedly inadequate and imbalanced, composed mainly of starchy foods, low-protein meals as well as less fruits and vegetables (FVs). Family diets are limited in fruits and vegetables, probably because of the higher costs of the same quantity of FVs compared to the starchy staples [6]. Promotion of diverse diets is one of several approaches to improving micronutrient nutrition for WRA, since dietary diversity is strongly associated with nutrient adequacy [8]. Therefore, this study assessed the dietary diversity of WRA in the districts of Kayunga and Jinja which are notable for their high levels of fruit and vegetable production.

METHODS AND MATERIALS

Study area and design

Data were collected from Kayunga and Jinja districts in Uganda during the month of August 2019. A cross- sectional study design was deployed. All women of reproductive age (15-49 years) in the selected villages who were willing to participate and were not pregnant were included in the study. One woman per household was selected to participate in the study. In Kayunga district, Kangulumira sub-county was selected, while in Jinja district, Budodo sub-county was selected.

Sample size determination

The sample size that was used in this study was calculated according to the equation by Lwanga, and Lameshow [9].
$n = Z^2_{1-a/2} P (1-P)/d^2$ Where: n = sample size per sub county, $Z_{1-a/2}$ = confidence level of 95% (standard value of 1.96)

P = proportion of households consuming fruits and vegetables (20%) in rural African settings [10], d= margin of error of 0.05, n= 1.96^2 *0.2(1-0.2)/0.052, n=0.614656/0.0025, n=246 per sub-county. Therefore, total sample number is 246* 2 sub counties= 492 respondents. To cater for drop out of respondents, during the data collection, the number of respondents per site was increased by 5%, totaling 517 respondents. However, data were captured from a total of 490 resulting into a response rate of 94.8 %.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Sampling technique

Multi-stage sampling was used. In the first stage, Kayunga and Jinja districts were purposively selected because they are large producers of jackfruit in Uganda [23] that was a target fruit in this study. Jackfruit is a nutrient- rich fruit and has been identified as one of the fruits that can greatly contribute to reduction of micronutrient deficiencies in women of reproductive age, as well as a good source of antioxidants for good health. One sub-county from each district was purposively selected. Random sampling was used to select 10 villages from each selected sub-county. With the guidance of the village chiefs, listing and mapping of households in each village were done to obtain household village lists. In each village, households were randomly selected from a generated village household list. If a household had more than two women aged 15-49 years, only one woman was considered for study.

Data collection tools

A structured questionnaire was used to collect information on household characteristics and socio demographic characteristics such as the sex and education level of the head of the household, and the number of household members. The questionnaire consisted of information on the women's age, education level, occupation, marital status, religion, ethnic group, nutrition education as well as vegetable and fruit production and consumption in the household.

Minimum dietary diversity for women (MDD-W)

A quantitative 24-hour recall questionnaire was used to collect data, because it is more elaborate when probing for food consumed by an individual, resulting in collecting more detailed data of food and drinks consumed by an individual [1]. All foods and beverages consumed the previous day and night were recorded under their respective food groups. The food groups were considered: Grains, white roots and tubers, and plantains; Pulses (beans, peas and lentils); Nuts and seeds; Dairy; Meat, poultry and fish; Eggs; Dark green leafy vegetables; Other vitamin A-rich fruits and vegetables; Other vegetables; Other fruits. The quality of diet for women of reproductive age was measured using the Minimum Dietary Diversity for Women (MDD-W) tool by recording all the foods and drinks consumed in the previous 24 hours. This tool is a dichotomous indicator of whether or not women 15-49 years of age consumed at least five out of ten defined food groups the previous day. The proportion of women 15-49 years of age who reached this minimum in a population was used as a proxy indicator for high micronutrient adequacy of diets [1]. The data were stratified by age as adolescent women (15-18 years) and older women (19-49 years). The number of women and proportion (%) who consumed a certain

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

food group on the previous day was computed by recording all the foods each woman had eaten the previous day. The dietary diversity score (DDS) of women of reproductive age was computed as the total number of food groups the woman consumed the previous day out of the ten defined food groups. The mean dietary diversity score of all the women in each stratum was got by adding up the individual DDS of all the women in each stratum and then calculated the mean as well as the standard deviation. The recommended number of food groups (minimum dietary diversity for women of reproductive age (MDD-W)) for a nutrient adequate diet is five and more. In each stratum, the total number of women that had consumed 1-4 and then 5 and more food groups were computed as well as their percentages to get the number and share (%) of women who consumed either less or the recommended number of food groups. Micronutrients of concern to women of reproductive age (usually deficient in their diets) in Uganda, were identified as vitamin A, B12, folate, calcium, iron and zinc [11]. The number women in each stratum that consumed foods from the food groups which are major sources of micronutrients that are usually lacking in women's diets were counted and proportions computed to get the women that are likely to have these nutrients in their diets for nutrient adequate diets and good health.

Ethical considerations

The study was approved by the Makerere University School of Health Sciences' Institutional Review Board who granted ethical approval (Permit No: 2019-026) and the Uganda National Council for Science and Technology who provided research clearance for the study (Permit No: A54ES). The study was permitted to be conducted in the two districts by the District Health Officers and District Agricultural Officers of each district. Makerere University provided an introduction letter to the study team to be presented to local authorities in each district. Information about the nature and objectives of the study was shared with respondents and a written and oral informed consent was obtained from each of the participants before the beginning of data collection. Participants were also informed that they had a right not to participate in the study and could withdraw at any time. Confidentiality was assured at all levels of the study.

Data management and statistical analysis

Data were collected using tablets, quality checks at data entry and post-survey data cleaning were done to ensure data quality. Statistical analyses performed using SPSS V27.3.7 (4293) Software. Data collected were stratified by age as adolescent women (15-18 years) and older women (19-49 years). Significance was set P=0.05. For continuous variables, mean values were computed while

proportions were computed for the descriptive variables that were placed under different themes and categories.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the sample

More than two thirds of the households in the present study were male headed (74%), owned land (78%) and animals (75%) with majority (74%) heads having attained primary level education (Table 1). More than half (55%) of the women had completed primary level education and about 60% were subsistence farmers. Most (66.2%) of these women cultivated cowpea leaves or jackfruit and more than three-quarters (82.2%) cultivated other fruits and vegetables. However, more than half (51%) did not consume fruit or vegetable in the previous seven days before the survey. A large majority (91.2%) of women had never received nutrition education.

Consumption patterns of food groups

Results for the consumption patterns of food groups are presented in Table 2. Overall, about 87% consumed the other vegetable food group that consisted of onions, tomatoes, green peppers and egg plants. On the other hand, about 40% of women consumed pulses, nuts and seeds, as well as meat, poultry and fish. Very few women consumed eggs (4.1%), vitamin A rich fruits (15.7%) and other fruits (5.1%). There was no significant difference ($p > 0.05$) between the two women age groups that consumed grains, white roots, tubers and plantains, pulses, nuts and seeds, as well as meat, poultry and fish. The diet was highly starch- based and food consumption among adolescents and older women of reproductive age followed a similar trend. This might be because starchy foods are cheaper than animal source foods and are readily available in the households as well as nearby markets. In addition, the focus is always put on starchy staples to meet the physiological need of satisfying the hunger unlike fruits and vegetables. Findings by Otunchieva *et al.* [12] also revealed that populations in developing countries have lower intake of protein source food groups than energy source food groups.

The low consumption of animal sourced food groups in the present study, which were also rich sources of iron, zinc, calcium, and vitamin B12, denied more than half of the women in these communities the nutrients which are of concern to women of reproductive age. Diets without vitamin A rich fruits and vegetables nor dark green leafy vegetables exposed more than 70% of the women to folate and vitamin A deficiency which nutrients are also of concern to WRA.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

The habitual daily diets of WRA were generally a starchy staple accompanied by a sauce from the pulse, nuts and seeds and occasionally meat food groups spiced with vegetables such as onions, tomatoes, and green pepper and egg plants. It was reported that dark green and leafy were used as sauce when the commonly consumed sauces were not available or expensive. The dark green leafy vegetables were usually home grown and considered to be a poor man's sauce. On the other hand, vegetables were used as sauce to accompany starchy staples during the times of famine and low-income. This made their consumption very low (less than 30%) when there were other alternative sauces. Although Kayunga and Jinja are known for growing a variety of fruits in large numbers big enough for local consumption, and sale to neighboring districts and countries, the consumption of the common commercial vitamin A-rich fruits was observed to be low in the present study. Low consumption is probably due to the general dietary habits of women in the selected districts. It is a common practice that in Central Uganda, women do not include fruits in household meal plans [13]. Results of this study are similar to those reported in eight Latin American countries among women of reproductive age in urban populations [14]. It was reported that nearly all WRA in urban Latin America depended on starchy foods probably due to its low cost. These foods were more resourceful in terms of satisfying family meals at a cheaper price compared with protein sources and vegetables that were more expensive and difficult to access for the low-income population [14].

The dietary patterns in the present study are in agreement with [15], who reported that the Ugandan diets are predominantly vegetarian with only 11-13% of the energy being supplied animal source foods. Among animal source foods, most of the energy is derived from roots and tubers (425-700g/d). Studies done in Mali and Kenya on dietary diversity of women of reproductive age showed that the women's diets in both countries were also starchy- based with low consumption of animal sourced foods. The proportion of WRA who consumed dark green leafy vegetables in Kenya (over 80%) was higher than that of Uganda (28%). However less than 20% of Kenyan women consumed vitamin A-rich fruits and vegetables [16, 17] and this proportion is similar to the results of the present study (15.7%).

Diet diversity score (DDS) of women of reproductive age (WRA)

Majority (81.8 %) of the WRA in Kayunga and Jinja districts had low DDS (Table 3). The mean dietary diversity score of the whole sample was 3.68 out of the ten possible maximum points score. This value was lower than the recommended cut-off criterion of five (5) or more food groups consumed for a diverse diet. Only 18.2% of the women had a diverse diet based on the cut-off criterion. There was no significant difference ($p>0.39$) in the mean dietary diversity score of the WRA

aged 15-18 years (3.8 ± 1.103) and 19-49-years (3.6 ± 1.089) age groups. None of the women consumed foods from all the food groups examined. The range of food groups consumed by WRA that participated in the study was 1 to 7. The mean dietary diversity score (DDS) of WRA and the proportion of women who reached the minimum dietary diversity for women of reproductive age (MDD-W) (18.2%) were low. The average DDS of women of 3.68 ±1.096 was lower than the 5-point cut-off proposed by FAO and FHI 360 [1]; this indicates inadequate consumption of micronutrients among women of reproductive age. It is however comparable with findings reported by [6], which revealed that the mean dietary diversity score of households in Uganda was: 4.8 nationally, 5 in central region without Kampala, and 4.9 in eastern region. Poverty is the chief driving force to low DDSs and food insecurity [6]. A study by Adubra *et al.* [16] among the rural Malian families revealed that the poorer the household, the more likely it was to be food energy deficient, have low dietary diversity, and have poor or borderline food consumption. The dietary diversity score results of women in this study is in the range of 3.78 ± 0.99 as reported among Kenyan women [17]. This indicates poor quality diets for WRA in both countries. A study of nutritional status of pregnant women in rural communities of Ethiopia also found a low DDS of 4.88. A high DDS was associated with food security and nutrition knowledge [18]. These results are in line with a comprehensive food security and vulnerability study done by UBOS and WFP [6] which found that three quarters of the Ugandan population had a low dietary diversity (they consumed food from fewer than four food groups). The UBOS and WFP [6] revealed that households that bought a higher share of food were likely to have a better quality diet, whereas those producing their own food, most probably a staple tended to cover their energy needs, but not their diversity requirements. Most of the women (60%) in the present study sites were farmers and produced most of the food consumed in their households. This implied that the low micronutrient intake due to low dietary diversity is partly caused by dependence on own production. A large proportion of these women, therefore, are at risk of micronutrient deficiencies due to consumption of diets low in micronutrients. In Uganda WRA are responsible for household food production and preparation [19]. Then again, previous studies in Mali [16] have documented low DDS among rural communities practicing own home production, who were associated with high staple consumption and poor quality diet. The Malian findings [16] are comparable to the findings in the present study, where majority (60%) of the respondents were practicing subsistence farming.

Similar studies done in Kenya and Mali found that the women's diets in both countries were of poor nutrient quality. The MDD reported in the present study was higher (81.8%) than that of the study in Mali (73%) [16] and Kenya (over 75%) [17].

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

A similar study conducted in Latin America found that 57.7% of WRA had a diverse diet [14]. The proportion of women meeting MMD-W in the present study was higher than that registered in Kenya, Mali and Latin America, probably because three previous studies were conducted in urban communities and these tend to have a diverse diet since they buy most of the food they eat [20]. The lower dietary diversity of women living in severe food insecure households has previously been associated with the low consumption of nutritious foods, including animal source foods and vitamin A-rich fruits and vegetables [16]. Women in households that produced a wider variety of food crops and livestock groups had greater odds of reaching minimum dietary diversity [16]. Women reaching the MDD-W consumed nutrient-rich foods, such as animal source foods and vitamin A-rich fruits or vegetables, more frequently [16].

Major food group as sources micronutrients of concern to women of reproductive age

About half (52%) of the women did not consume foods from food groups that are major source of micronutrients (Table 4). The food groups included vitamin A-rich fruits and vegetables, animal protein food groups, dark green leafy vegetables, pulses as well as nuts and seeds. Calcium rich food groups were the least consumed and less than a third (28.9%) of the women consumed these food groups. The trend of food group consumption was similar between adolescents (15- 18 years) and the older women (19-49 years). A low proportion (4.1%) of women consuming food items from food groups that are major sources of micronutrients of concern was registered (Table 4). Mostly consumed food group among those that are major sources of nutrients of concern to WRA was the meat group (32.2%). Despite most of the foods in meat food group were expensive, silverfish was registered in the present study as the most consumed, because it was affordable and readily available. The least consumed food groups were eggs (4.1%) and vitamin A-rich fruits and vegetables (15.7%). Eggs which are rich sources of most of the nutrients of concern to WRA (Vitamin A, vitamin B12, calcium, iron and zinc), their consumption was low probably because chickens in these communities were reared at a very small scale and the eggs were kept for reproduction. Some of the common vitamin A-rich fruits in these communities were pawpaw and jackfruit; the pawpaws were grown for commercial purposes while jackfruits were, once in a while, eaten and the rest left to go to waste. The low consumption of the essential nutrients in this study suggests that the women are at risk of micronutrient deficiencies and poor health. This probably indicates the reasons why there is high prevalence of iron deficiency and vitamin A deficiency reported among women of reproductive age in Uganda. The possible reasons for these micronutrient deficiencies are low income level and lack of education about

healthy practices like healthy eating patterns [21]. The present findings are consistent with a study by Ruel *et al.* [10] in sub-Saharan Africa, which reported that: low fruit and vegetable intake is a main contributor to micronutrient deficiencies in the developing world, especially in populations with low intakes of nutrient-dense animal source. Another Ugandan study by Phil *et al.* [15] found that the women's diet were highly inadequate for vitamin A, vitamin B-12 iron, zinc and calcium based on the dietary profile, which featured low levels of consumption of milk, meat, fish and eggs. A study by UBOS and WFP [6] reported that: many rural Ugandan communities had a diet that was poor in micronutrient rich foods such as meat, fish, fruit, and dairy. These communities were food insecure: their diets were non-diverse, unbalanced and unhealthy. Hungry people do not consume nutrient-dense foods that can provide a good source of protein and micronutrients but spend a larger share, if not all of their food budget on macronutrient dense staples, such as rice and wheat, which provide cheap sources of calories. The high proportion (over 60%) of women of reproductive age that do not consume fruits, vegetables as well as animal sourced food groups explains the big percentage of vitamin A and iron deficiencies, the poor birth outcomes for both women and their babies, the general poor health, and low productivity reported among women in Uganda. This is due to their dietary habits, small food budget and lack of knowledge about the importance of various food nutrients as well as how to balance their intake for good health [22].

CONCLUSION

Although Kayunga and Jinja districts are among the major producers of fruits and vegetables in Uganda, which are major sources of micronutrients, their consumption was low since they were not habitually part of the daily meal plan but were once in a while consumed, putting the WRA at risk of micronutrient deficiencies. The diets of women were of poor quality despite the availability of nutrient dense foods in the communities.

This study identified that a number of food groups, which are major sources of micronutrients of concern to WRA are consumed by less than half of the women. This is due to WRA having poor dietary habits, small food budget and lack of knowledge about the importance of various food nutrients as well as how to balance their intake for good health.

It is recommended to train women on the importance and benefits of consuming fruits and vegetables as well as animal source foods (in particular organ meat) and the consequences of low or non-consumption. Promotional efforts combined with

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

production interventions with strong education and behavior change activities, are needed to influence consumption behavior and promote fruit and vegetable intake, addressing the main constraints to micronutrient consumption among women of reproductive age.

ACKNOWLEDGEMENTS

The project was supported by funds of the Federal Ministry of Food and Agriculture (BMEL) based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE).

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 1: Household socio-demographic characteristics

Demographic characteristic	Freq.	Percent (%)
Household characteristics n=488		
Household size		
1-5	219	44.8
6-10	242	49.5
11-15	22	4.5
16-20	4	0.8
Did not respond	1	0.4
Land ownership		
Yes	381	78.1
No	107	21.9
Animal ownership		
Yes	365	74.8
No	123	25.2
Toilet facility		
Yes	467	95.7
No	21	4.3
Household head characteristics, n=488		
Sex of household head		
Male	361	74.0
Female	127	26.0
Age of household head		
20-49	248	50.8
50-79	98	20.1
80-99	6	1.2
Did not know/respond	136	27.9
Education level of household head		
None	138	28.3
Primary	193	39.6
Secondary	125	25.6
Tertiary	13	2.6
Other (do not know / no response)	19	3.9
Women's characteristics, n=488		
Age		
15-18	37	7.6
19-49	451	92.4
Education		
None (No education)	43	8.8
Primary	270	55.3
Secondary	156	32.0
Tertiary	12	2.5

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Other (Student…..)	7	1.4
Marital status		
Single	127	26.0
Married	361	74.0
Occupation		
Farmer	294	60.2
Teacher	44	9.0
Trader	17	3.5
Other (student, cooks, small business, civil servants, Village Health Team-VHT)	**41**	**8.4**
None, (housewife, unemployed)	92	18.9
Ethnicity		
Basoga	241	49.4
Baganda	112	23.0
Iteso	13	2.6
Bagisu	44	9.0
Other (Bagwere, Banyole, Banyoro, Bululi, Banyankole, Sudans, Tanzanians, Rwandan	78	16.0
Cowpea leaves or Jackfruit cultivation		
Yes	323	66.2
No	165	33.8
Other vegetable or fruit cultivation		
Yes	401	82.2
No	87	17.8
Seven-day vegetable or fruit consumption		
Yes	238	48.8
No	250	51.2
Ever had Nutrition education		
Yes	43	8.8
No	445	91.2

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 2: Number of women and share (%) who consumed a certain food group from one 24-hour recall during the lean season

Food group	Overall		Age group (Years)			
	n=490		15-18 (n=34)		19-49 (n=456)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Grains, white roots & tuber & plantains	490	100	34	100	456	100
Pulses	149	30.4	15	44.1	134	29.4
Nuts & seeds	182	37.1	14	41.2	168	36.8
Dairy	118	24.1	7	20.6	111	24.3
Meat, poultry & fish	158	32.2	14	41.2	144	31.6
Eggs	20	4.1	3	8.8	17	3.7
Dark, green, leafy vegetables	137	28	5	14.7	132	28.9
Vitamin A rich fruits and vegetables	77	15.7	3	8.8	74	16.2
Other vegetables	425	86.7	30	88.2	395	86.6
Other fruits	25	5.1	3	8.8	22	4.8

Table 3: Diet diversity score (DDS) and proportion of women attaining the minimum DDS

Dietary diversity score (DDS) of women of reproductive age				Number of women of reproductive age who consumed low and adequate food groups			
				< 5 (Low)		≥ 5 (Adequate)	
Age group (Years)	n	Mean±Standard deviation	P	Freq.	Percent	Freq.	Percent
15-18	34	3.76±1.103		29	85.3	5	14.7
19-49	456	3.60±1.089	0.39	372	81.6	84	18.4
Overall	490	3.68±1.096		401	81.8	89	18.2

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 4: Micronutrients of concern to women of reproductive age and their major food group sources with the proportion of women that consumed those food groups

Micronutrient of concern to WRA	Food group major source of micronutrient	Percentage of women that consumed food from a certain group		
		Overall	Age group (Years)	
			15-18	19-49
Vitamin A	Vitamin A rich fruits and vegetables	15.7	8.8	16.2
	Meat, poultry and fish (Mainly; organ meat)	32.2	41.2	31.6
	Eggs (yolk)	4.1	8.8	3.7
Vitamin B12	Meat, poultry and fish (Mainly; organ meat)	32.2	41.2	31.6
	Dairy	24.1	20.6	24.3
	Eggs	4.1	8.8	3.7
Folate	Dark, green leafy vegetables	28	14.7	28.9
	Meat, poultry and fish (Mainly; liver)	32.2	41.2	31.6
	Pulses	30.4	44.1	29.4
Calcium	Dairy	24.1	20.6	24.3
	Eggs	4.1	8.8	3.7
	Dark, green leafy vegetables	28	14.7	28.9
Iron	Meat, poultry and fish (Mainly; liver)	32.2	41.2	31.6
	Eggs	4.1	8.8	3.7
	Dark, green leafy vegetables	28	14.7	28.9
	Pulses	30.4	44.1	29.4
	Nuts and seeds	37.1	41.2	36.8
Zinc	Meat, poultry and fish (Mainly; liver)	32.2	41.2	31.6
	Dairy	24.1	20.6	24.3
	Eggs	4.1	8.8	3.7

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 5 May 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

REFERENCES

1. **FAO and FHI 360.** Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO, 2016.

2. **Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S and M Pate** High-quality health systems in the Sustainable Development Goals era: time for a revolution. *The Lancet global health*, 2018; **6(11):**e1196-e1252.

3. **Otunchieva A, Smanalieva J and A Ploeger** Dietary Quality of Women of Reproductive Age in Low-Income Settings: A Cross-Sectional Study in Kyrgyzstan. *Nutrients*, 2022; **14(2):**289.

4. **Uganda Bureau of Statistics – UBOS, ICF.** Uganda Demographic and Health Survey 2016. In. Kampala, Uganda; UBOS and ICF; 2018.

5. **Uganda Bureau of Statistics, ICF international Inc.** Uganda Demographic and Health Survey 2011. In. Calverton, Maryland, USA; 2012.

6. **Uganda Bureau of Statistics (UBOS) and World Food Program (WFP).** Comprehensive Food Security and Vulnerability Analysis (CFSVA). Kampala, Uganda 2013.

7. **Elodie B, Capon G and Y Martin-Prevel** Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Ouagadougou, Burkina Faso Site. Washington, DC: Food and Nutrition Technical Assistance II Project (FANTA), FHI 360 2009.

8. **Schreinemachers P, Simmons EB and MC Wopereis** Tapping the economic and nutritional power of vegetables. *Global food security*, 2018; **16:**36-45.

9. **Lwanga SK and S Lameshow** Sample size determination in health studies: A practical manual. Geneva. World Health Organisation 1991.

10. **Ruel MT, Minot N and L Smith** Patterns and determinants of fruit and vegetable consumption in Sub- Saharan Africa: a multi-country comparison. International Food Policy Research Institute, World Health Organization (WHO) 2005.

11. **Ministry of Health (MoH).** Guidelines on Maternal Nutrition in Uganda. Kampala, Uganda (2010).

12. **Otunchieva A, Smanalieva J and A Ploeger** Dietary Quality of Women of Reproductive Age in Low-Income Settings: A Cross-Sectional Study in Kyrgyzstan 2022. *Nutrients*, 2022; **14(2):**289.

13. **Bukusuba J, Kaaya AN and A Atukwase** Risk factors for stunted growth among children aged 6–59 months in rural Uganda. 2017. *Int J Nutr*, 2017; **2(3):**1-13.

14. **Gómez G, Previdelli AN, Fisberg RM, KOvalskys I, Fisberg M, Herrera-Cuenca M, Sanabria LYC, Garcia MCY, Rigotti A, Liria-Dominguez MR, Guajardo V, Quesada D, Murillo AG and JC Brenes** Dietary Diversity and Nutrients Adequacy in Women of Childbearing Age: Results from ELANS Study. 2020. *Nutrients* 2020; **12**,1994. https://doi.org/10.3390/nu1207

15. **Phil H, Rambeloson Z and O Dary** The 2008 Uganda Food Consumption Survey: Determining the Dietary Patterns of Ugandan Women and Children. A2Z: The USAID Micronutrient and Child Blindness Project AED. Washington D.C 2010.

16. **Adubra L, Savy M, Fortin S, Kameli Y, Kodjo NE, Fainke K, Mahamadou T, Le Port A and Y Martin-Prevel** The Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) Indicator Is Related to Household Food Insecurity and Farm Production Diversity; Evidence from Rural Mali. *Current Developments in Nutrition,* 2019; **3:** nzz002.

17. **Gitagia MW, Rose Ramkat C, Mituki DM, Termote C, Covic N and MJ Cheserek** Determinants of dietary diversity among women of reproductive age in two different agro-ecological zones of Rongai Sub-County, Nakuru, Kenya. *Food and Nutrition Research,* 2019; **63:**1553.

18. **Tsegaye D, Tamiru D and T Belachew** Factors Associated with Dietary Practice and Nutritional Status of Pregnant Women in Rural Communities of Illu Aba Bor Zone, Southwest Ethiopia. *Nutrition and Dietary Supplements,* 2020; **2020:**103-112. https://doi.org/10.2147/NDS.S257610

19. **Jordan I, Röhlig A, Glas MG, Waswa LM, Mugisha J, Krawinkel MB and EA Nuppenau** Dietary Diversity of Women across Agricultural Seasons in the Kapchorwa District, Uganda: Results from a Cohort Study. 2022; *Foods*, 2022; **11(3):**344.

20. **Bellon MR, Ntandou-Bouzitou GD and F Caracciolo** On-Farm Diversity and Market Participation Are Positively Associated with Dietary Diversity of Rural Mothers in Southern Benin, West Africa. PLoS ONE 2016; **11(9):** e0162535. https://doi.org/10.1371/journal.pone.0162535

21. **Dunneram Y and R Jeewon** Healthy diet and nutrition education program among women of reproductive age: a necessity of multilevel strategies or community responsibility. 2015; *Health Promotion Perspectives*, 2015; **5(2):**116.

22. **McNamara K and E Wood** Food taboos, health beliefs, and gender: understanding household food choice and nutrition in rural Tajikistan. *Journal of Health, Population and Nutrition*, 2019; **38(1):**1-14.

23. **Balamaze J, Muyonga JH and YB Byaruhanga** Production and utilization of jackfruit (Artocarpus Heterophyllus) in Uganda. *Afr. J. Food Agric. Nutr. Dev.* 2019; **19(2):**14289-14302 https://doi.org/10.18697/ajfand.85.17290