ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 1 January 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2023; 23(1)22149-22171 https://doi.org/10.18697/ajfand.116.22645

MARITAL TRANSITION IS ASSOCIATED WITH FOOD INSECURITY, LOW DIETARY DIVERSITY, AND OVERWEIGHT IN A FEMALE POPULATION IN RURAL GHANA

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ABSTRACT

Research from high-income countries shows that marital transition affects individuals' nutrition outcomes. Yet, little is known about its effect on women's food security status and nutrition outcomes in Sub-Saharan Africa. Moreover, most published studies merge cohabitation and marriage into one category, but these statuses might have a distinct effect on nutrition outcomes in different settings. This study examined the association between the marital transition of women living in a rural district in Ghana and their food security status, minimum dietary diversity, and overweight (body mass index (BMI) ≥ 25 kg/m2). This analysis used representative data from women with a child less than 12 months from the Upper Manya Krobo District, which was collected for the 2014 baseline of the Nutrition Links project in 137 villages (clinicaltrials.gov NCT01985243). Women's marital transition was assessed by merging their current and previous marital status into five categories: i) continuously married; ii) remarried; iii) cohabitating with a previous union; iv) cohabitating with no previous union; v) single (majority never previously married). The adjusted logistic regression showed that, compared to women who were continuously married, those cohabitating—with or without a previous union—and those who were single were more likely to be food insecure (aOR = 2.49; 95% CI [1.31, 4.72], aOR = 2.01; 95% CI [1.13, 3.58], and aOR = 1.85; 95% CI [1.02, 3.38], respectively). Women who were cohabitating—with or without a previous union—were more likely not to meet the minimum dietary diversity than those who were continuously married (aOR = 1.82; 95% CI [0.98, 3.38] and aOR = 1.78; 95% CI [1.01, 3.12], respectively). Finally, compared to the continuously married group, cohabitating women with no previous union were less likely to be overweight (aOR = 0.40; 95% CI [0.22, 0.74]). These results are consistent with previous publications that showed married women were wealthier and more overweight. Moreover, these results indicate that cohabitation affects nutrition-related outcomes differently compared to marriage in a sub-Saharan setting. More attention must be placed on better understanding the social aspects that link women's marital transition to diet and nutrition outcomes.

Key words: Marriage, marital status, food security, diet, overweight, women, Ghana, Africa

https://doi.org/10.18697/ajfand.116.22645

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INTRODUCTION

Globally, recent reports stated that 2.3 billion people experienced food insecurity (FI) while 1.9 billion adults were overweight [1, 2]. The coexistence of high levels of food insecurity (FI) and overweight is particularly evident in middle-income countries where nutrition transition combines poverty and infectious diseases with increasing sedentary lifestyles and access to cheap ultra-processed foods [2]. Sub-Saharan Africa (SSA) has the highest prevalence of FI, where together with overweight, it predominantly affects women [3, 4].

Marital transition—defined as a change in marital status within a time frame, which can occur as an entry into marriage, a marital dissolution (due to divorce, widowhood, separation), or an entry into a marriage after a marital dissolution—is a sociodemographic factor that influences health-related behaviour and outcomes [5]. For instance, marital dissolution has been associated with increased mental distress which could lead to poor health habits such as smoking and lower vegetable consumption [7, 8]. Marital dissolution has also been associated with weight loss, while weight gain has followed transitioning into marriage [7, 9, 10]. An analysis of four waves of a 15-year cohort in the United States found that marital transition was a better predictor of body weight than current marital status [11].

Two main theories - “social selection” and “social causation”—help explain some of these mental and physical observations outcomes (**Figure 1**). The social selection theory poses that people who are doing worse in some respects before getting into a union (married/cohabitating) are less likely to either marry or remain married than those who are doing better (such as pre-marital disability) [7, 12, 13]. The social causation theory suggests that individuals who are in a union may have increased social support and economic security than their unmarried counterparts [7, 12]. On the other hand, a marital/union disruption may cause a temporary crisis affecting one’s well-being (that is, post-marital disability). In addition, problems that did not exist before a union may arise during marriage/cohabitation, making a marital dissolution more likely [7, 12].

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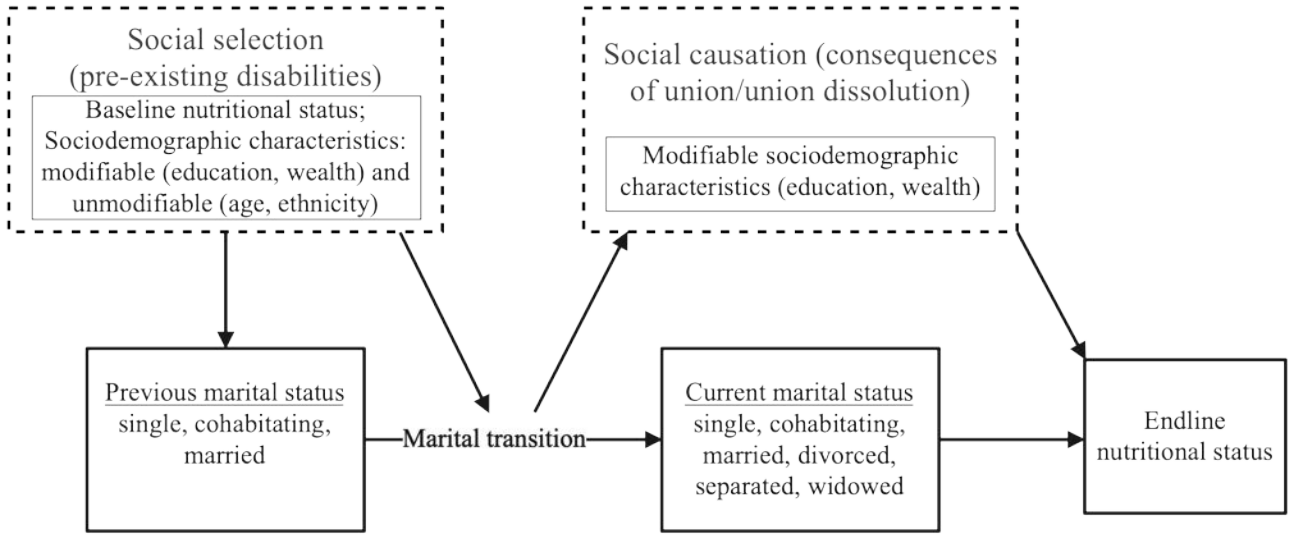

Figure 1: Conceptual framework on how marital transition might affect nutrition outcomes of rural Ghanaian women

The top dashed boxes show the underlying social theories that might explain determinants and outcomes of marital transition and nutritional status (bottom boxes). They are dashed because they were not assessed. On the left, the "social selection" theory proposes the existence of pre-marital or post-marital disabilities, suggesting that people who are worse-off in some ways before getting into a union (married/cohabitating) are less likely to either marry or remain married than those who are doing better. In contrast, problems that did not exist before may arise during marriage/cohabitation, making a marital dissolution more likely. On the right, the theory of "social causation" suggests that individuals who are in a union are doing better because of their union ("protective marriage" or "social protection") or are doing worse because of a marital/union dissolution ("crisis") (Bloom *et al.* [12]; Josefsson *et al.* [7], Wade & Pevalin [13]).

In addition, within these boxes are the baseline nutritional status and modifiable and unmodifiable sociodemographic characteristics that could have acted as pre-existing disabilities, influencing marital status/transition (on the left), and modifiable sociodemographic characteristics that could have been affected by the marital transition (on the right).

Most studies have focused on marital status instead of marital transition, and few studies have analysed the topic in SSA contexts, where a wide range of marital structures exist [14]. For example, in Ghana, the law recognizes three types of marriages - ordinance (monogamous legal union), customary (characterized by the payment of a bride price by the groom's family), and Islamic.

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Marriage is one of the most important social institutions in Ghana and, together with having children, is a sign of wealth and success [15]. In 2014, 42% of Ghanaian women of reproductive age were married [16]. Previous estimations show that about 80% of these marriages were customary [14]. Informal marriages (cohabitating), which increased from 8% in 2003 to 14% in 2014, are not legally recognized and may not be covered by local inheritance rights in case of dissolution [16-18]. About 33% of women in 2014 were single (never married), and nearly 11% of women were divorced/separated/widowed [16]. The prevalence of divorce/separation did not change much from 2003 (7%) to 2014 (8%) [16, 17], but an analysis using the 2008 Demographic Health Survey dataset showed that about 33% of first-time marriages might end in divorce within the first 15 to 19 years [19].

This study explored the association between marital transition and food security, dietary diversity, and overweight using data from a representative sample of adult women with infants in a rural district in Ghana.

MATERIALS AND METHODS

This secondary analysis used the baseline data from the Nutrition Links project, which aimed to improve rural households' food and nutrition security in Upper Manya Krobo—a mainly rural and underserved district located in Ghana's Eastern Region [20]. The data were collected district-wide between December 2013 and May 2014 from a representative sample of 1,122 adult women caregivers of a child aged < 12 months [21]. In the district, over eight in ten households were engaged in agriculture, mainly for subsistence [20]. The main ethnic group was Krobo, a subgroup of the Ga-Dangme—a patrilineal ethnic group. Women's marital status in the district had a similar distribution to the country's average, with most women being in a union, predominantly married.

Independent variable: marital transition

Women's current marital status was collected as i) married, ii) cohabitating, iii) divorced, iv) separated, v) widowed, or vi) never married. Nearly half of the women were cohabitating (48.8%, n = 544), while one in four were either married (25.4%, n = 283) or single never married (24.6%, n = 274). Only thirteen women (1.2%) who were not in a union were either divorced, separated, or widowed. Except for those who were always single, respondents were further asked if they had a previous marriage or union. Nearly one in four women had a previous union/marriage (23.9%, n = 248), which in most cases ended in divorce (57.7%, n = 143), followed by separation (32.7%, n = 81) and widowhood (9.7%, n = 24). Of

https://doi.org/10.18697/ajfand.116.22645

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the 1,122 interviewed women, 1,039 (92.6%) had complete information on current and previous marital status.

The survey also collected information on the year of the start of the current and previous unions, but this information was missing for a large proportion of cases (~25% of cases for current union and ~40% for previous unions). The type of marriage (ordinance, customary, or Islamic) was not collected. For this analysis, women's current and previous marital statuses were merged into a marital transition variable **(Figure 2).** Women who were previously separated or widowed were merged with those previously divorced into a "previous union" subcategory, given the low number of cases. Finally, marital transition was categorized as 1) continuously married (married and no previous union dissolution), 2) remarried (married with a previous union dissolution ending in either divorce, separation, or widowhood), 3) cohabitating without a previous union, 4) cohabitating with a previous union, and 5) single. All final models were both run, including these thirteen women and excluding them; discrepancies are reported.

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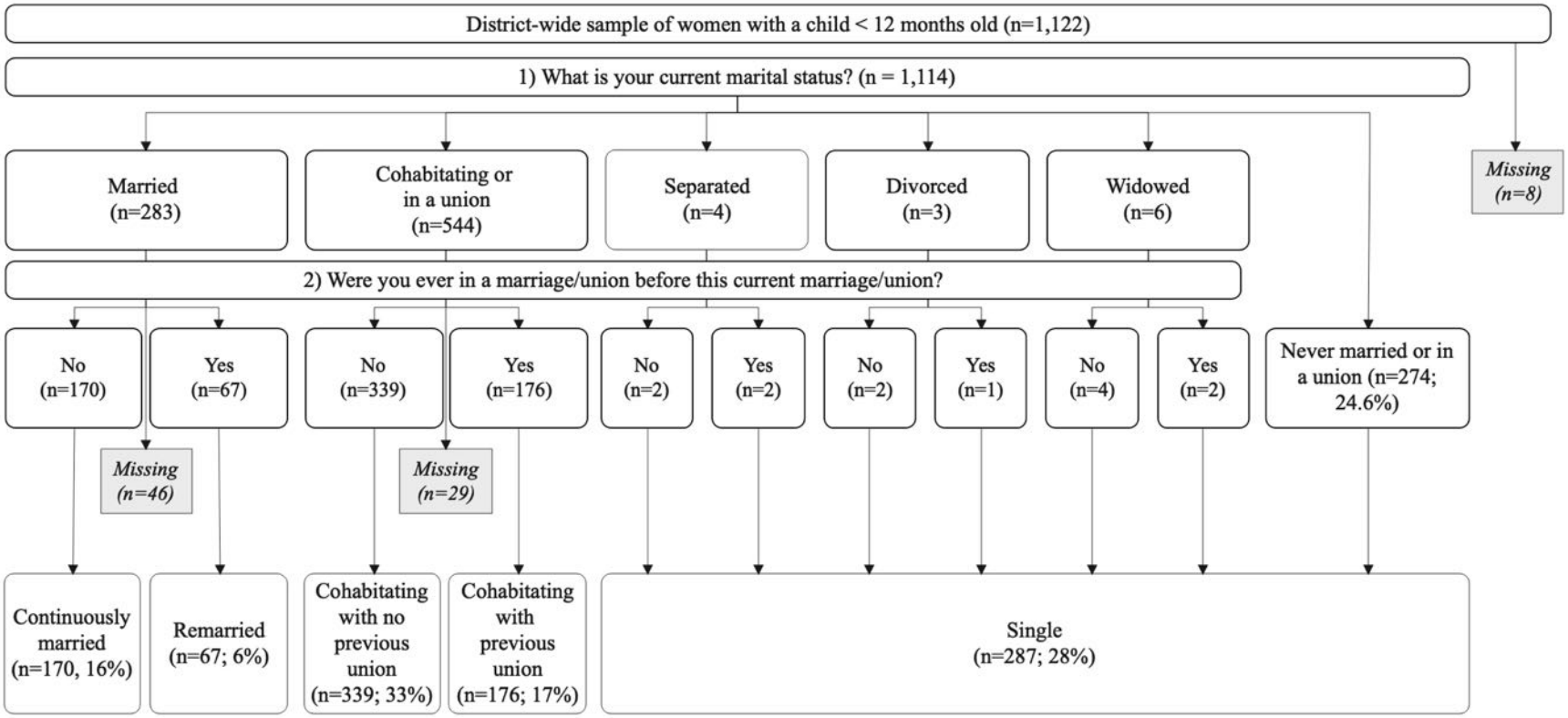

The figure shows the cases for which there was information for 1) current and 2) previous marital status and how these variables were merged to create the five marital transition categories at the bottom

Figure 2: Classification or marital status based on Nutrition Links survey questions

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Dependent variables

Household food security. Household food security was assessed using a 15-item FI experience scale, which covers a range of experiences going from the least severe (worried about running out of food) to items asking about the quality of meals and going up in severity up to running out of food within the past 30 days [22]. Households were defined as food insecure if they responded affirmatively to ≥ 1 item(s) [4].

Women's minimum dietary diversity. The Nutrition Links implemented its baseline survey before the FAO's Minimum Dietary Diversity for Women (MDD-W) publication, which uses a cut-off of an intake of five out of ten food groups to assess dietary diversity [23]. Thus, women's MDD-W was determined using WHO's 2008 food groups for children's complementary feeding [24]. Not meeting the MDD-W was defined as an intake of < 4 out of 7 food groups (that is, grains and tubers, legumes, dairy, flesh [meats and organs], eggs, vitamin A-rich fruits, and vegetables and other fruits) in the previous week.

Women's overweight. Body measurements were collected in duplicate based on standard methods using a digital scale (Tanita Corporation of America, Inc., Arlington Heights, IL, USA) to measure weight to the nearest 100 g and a stadiometer for height to the nearest 0.1 cm. Overweight was defined as a body mass index (BMI) ≥ 25 kg/m^2.

Sample characteristics and covariates

Sociodemographic characteristics of women and their households were used to describe the sample and as potential covariates. Principal Component Analysis was used to create wealth variables. The analysis resulted in three factors encompassing 12 variables. Factor 1 loaded strongly (that is, rotated component matrix's coefficients >0.30) on poultry, small ruminants, agricultural land, toilet, and number of rooms and was named rural component. Factor 2 loaded strongly on radio, watch, mobile, and bank account and was named assets component. Factor 3 loaded strongly on the remaining variables (floor and wall materials and source of drinking water) and was named household component. A variable to account for seasonality was computed—dry season from November to March and wet from April to October [20].

Data analysis

The sociodemographic characteristics were described by marital transition groups using One-way ANOVA for continuous variables and chi-square test of independence for categorical. If the chi-square test of independence was < 0.05,

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Z-tests were used to compare marital transition groups [25]. Bonferroni's post hoc adjustment was used for all group comparisons.

Adjusted binomial logistic regression models (PROC LOGISTICS) explored the association between outcomes—FI, MDD-W, and overweight—and marital status. The sample size available for each model is shown in Figure 3. The association between sociodemographic covariates (including the quadratic effect of continuous variables) and the outcomes was tested. If the p-value for this association was <0.10, the covariates were included in the adjusted model. The final model included only covariates with p-values <0.05. Age was kept in all models disregarding its association with the outcome due to its association with marital status. The confidence intervals (CI) of all predictors were determined using Dunnett's test, which adjusts for comparing multiple marital transition categories with a single reference category (continuously married) [26]. All analyses were run using SAS 9.4.

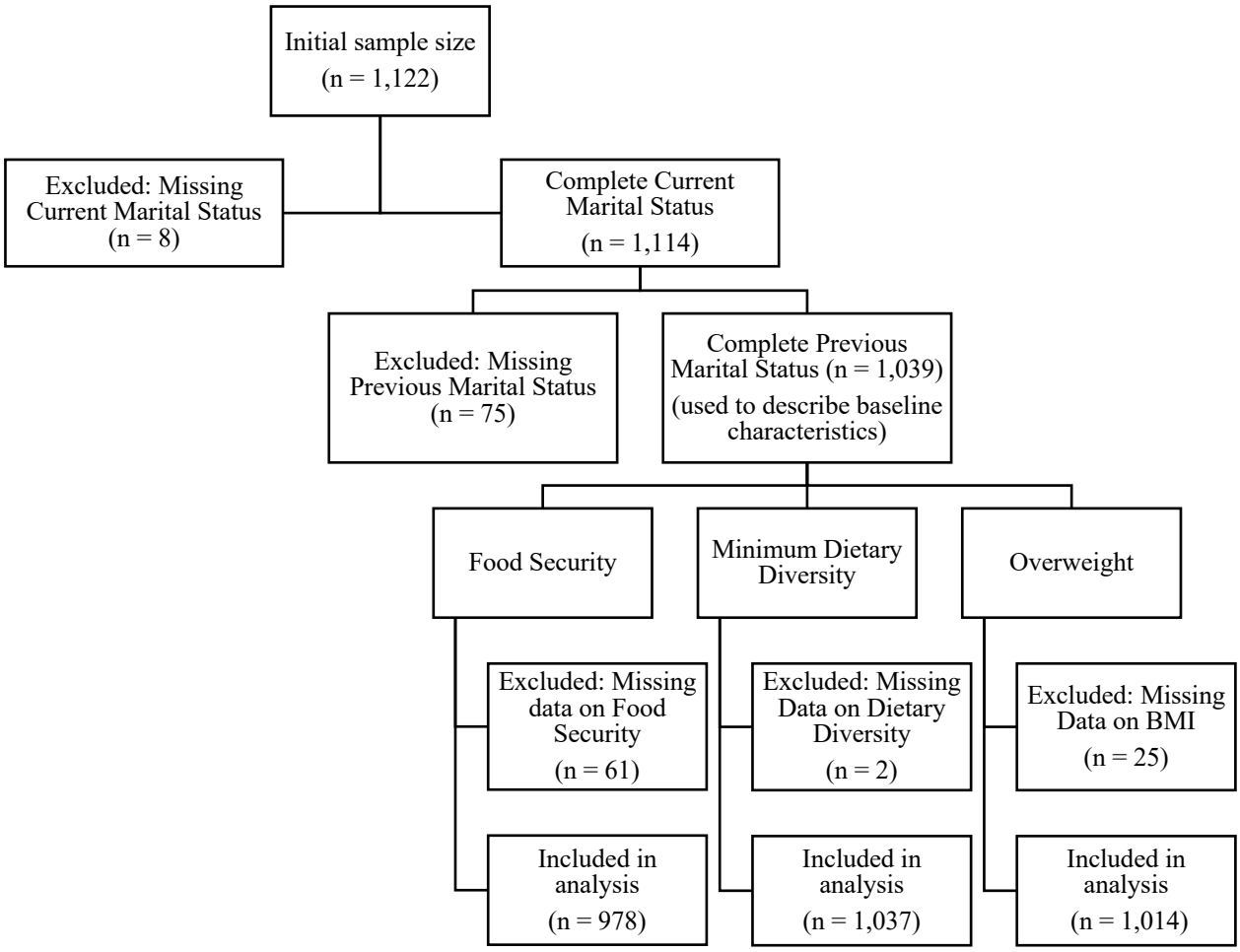

Figure 3: Flow chart of sample used for data analysis

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Ethical approval

The Nutrition Links trial was registered at Clinicaltrials.gov (NCT01985243). Institutional Review Board approval was obtained from the Noguchi Memorial Institute for Medical Research at the University of Ghana (# 060/13-14) and McGill University (# 822-0514). All participants provided written informed consent.

RESULTS AND DISCUSSION

Participants' characteristics

Women were 27.3 ± 7.7 years old and mostly Krobo (82.8%); only 3% were from a matrilineal ethnic group (that is, Akan). Most women had an income-generating activity (75.3%), mainly as farmers (33.0%) or traders (33.2%). Education level was low, with 62.6% of the women not having completed more than primary school. Food insecurity affected 57.8% of the households. The average number of food groups consumed by them was very low—only 3.2 ± 1.4 out of seven food groups. As a result, 60.8% of women did not meet the MDD-W. More than one quarter (27.6%) of the women were overweight.

Continuously married women were older, less likely to be Krobo, and more likely to be overweight than women who were cohabitating or single (Table 1). Cohabitating women who had a previous union were more likely to be farmers than single and cohabitating women without a previous union. Further, these women were less likely to have completed secondary school than those with no previous union (including married, cohabitating, or single). Finally, single women were the youngest and were more likely to have no income-generating activity.

Marital transition as a predictor of food insecurity and minimum dietary diversity

Compared to continuously married women, those cohabitating—with or without a previous union dissolution—were more likely to be food insecure and not to meet the MDD-W (Table 2). Single women were also more likely to be food insecure than continuously married women, but there was no difference in meeting the MDD-W. In 2010, only 33% of the households were nuclear (parents + children) in the Upper Manya Krobo District [20]. Thus, single mothers may have been living with their parents or extended families and having their economic support. On the other hand, single mothers who are the heads of their households may represent the "survivors" (citing Clark and Hamplová [27]), given that the economically most vulnerable females may have entered male-headed households (either through marriage or cohabitation) as a survival strategy.

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Considering the social status associated with marriage in Ghana [15], it is likely that some of the women who were cohabitating would have preferred to be married. Based on the "social selection" theory, it is possible that these women might have already had "pre-marital disabilities" (for example, being poor and food insecure), making them less likely to marry [7, 12, 13]. In addition, as reported in studies from high-income countries, having children from a previous union could have decreased the likelihood of these women remarrying, especially if their children were young and numerous [28]. Notably, though, in this sample, the number of children < 5 y living inside the household and the proportion of women with children < 18 y living outside the household did not differ between remarried women and cohabitating women with a previous union (Table 1). In other cases—as suggested by Hudson & Matfess [29]—men may have intended to marry, but their low economic status or a high bride price might have impeded its settlement. In the case that the couple was in the process of paying the bride price, this significant expense could have reduced the household's capacity to meet basic needs (such as food), as found in a Timor Leste mixed-methods study by Rees *et al.* [30].

For women who had a previous union dissolution, it is possible that this transition triggered an economic crisis. An analysis of two cohorts of Canadian adult women showed that their income significantly reduced after separation [31]. For example, those who had a union dissolution in 2002 endured a drop in post-tax household income of $10,222 ($p<0.001$). This decrease was not seen in women who re-partnered. In Ghana, the woman's family may have to return the bride price either totally or partially when there is a divorce [19, 32]. This may pose a higher hardship for women in patrilineal societies, where the bride price tends to be higher than in matrilineal societies.

Even though the break-up of a union may negatively affect women, it is noteworthy that it may also reflect their autonomy [32]. An analysis of two consecutive Demographic and Health Survey datasets found that women who went to school—a proxy of autonomy—were more likely to divorce compared to those who did not attend school. For example, those who went to high school had an increased odds of being divorced of 1.61 ($p<0.001$) in 1998. Further, although a union dissolution poses a stressful situation, with time, it can promote resilience in individuals [33]. This built resilience could potentially explain why some of the women who were currently married but had a previous union dissolution did not fare worse in these outcomes than those continuously married in this sample.

https://doi.org/10.18697/ajfand.116.22645

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Marital transition as a predictor of overweight

Compared to continuously married women, only women who were cohabitating and had no previous union were less likely to be overweight (Table 2). Based on the theory of "protective marriage" [7, 12], married women may count on more social and economic support than their unmarried counterparts. Some authors argue that traditional marriages reinforce the unions' stability [19, 32], which may happen partly because traditional marriages symbolize the union of two families instead of two individuals [19].

In the last Ghana Demographic and Health Survey, the prevalence of overweight was highest among the wealthiest women (from 12.6% in the lowest to 60% in the topmost wealth quintile) [16]. In this analysis, wealth was also associated with overweight, but the three wealth indicators showed mixed associations. Women who ranked higher on the assets (for example, radio, watch, and mobile) and household (wall and floor materials) components were more likely to be overweight. In contrast, those who ranked higher in the rural component (for example, poultry, small ruminants, and agricultural land) were less likely to be overweight. Given that women's primary occupation did not enter the models, these results may reflect their households' main economic activities, dividing more rural households from the others.

The preferred body image is another plausible explanation for why married women were more likely to be overweight. A cross-sectional study in a Ghanaian metropolis showed silhouettes illustrating a range of BMIs to 394 adult women [34]. Women rated overweight silhouettes (BMI 28 to 30 kg/m^2) as the most socially valued and obese silhouettes as affluent (BMI 30 to 33 kg/m^2). In a prior Senegal study, women also rated overweight as the socially preferred body size [35]. The "social obligation" hypothesis proposes that people follow social norms [7]. A socially preferred larger body size might have been more accessible for wealthier married women than for others. On the other hand, men may be more attracted to women with larger body sizes, increasing the likelihood of larger-sized women to marry, as would be suggested by the "social selection" theory.

Age was also associated with being overweight in this sample and in an analysis of the last three Ghana Demographic Health Survey datasets (2003, 2008, and 2014) [36]. Compared to women aged 15–24 years, the likelihood of being overweight increased every ten years, except for those aged ≥ 45 years. For instance, nulliparous women aged 25-34 years and 35-44 years were two-fold and three-fold more likely to be overweight than those aged 15–24 years, respectively (aOR = 2.03, 95% CI [1.56, 2.64]; aOR = 3.58, 95% CI [2.15, 5.97]). A similar trend was

https://doi.org/10.18697/ajfand.116.22645

observed for their parous counterparts. Likewise, an analysis using data from the Global Burden of Disease Study found that overweight increased steeply from 20-24 years up to 35-39 years in women and men [37].

Limitations

This study has several limitations. Firstly, the data on previous and current marital status and the outcomes of interest were collected cross-sectionally. Thus, the study is limited to looking at associations without having clear timelines for the outcomes. Also, it is impossible to infer if there was any recovery between the previous marriage dissolutions and the entrance into the new unions. Moreover, the duration of the relationships could change the observed associations with the outcomes, but there was insufficient information to include it in the models.

Secondly, the marital transition variable does not reflect the different types of unions that exist in the country; it did neither record whether the reported marriage referred to an ordinance, an Islamic, or a customary marriage, if these relationships were polygynous, nor the amount settled nor paid for the bride price. All these factors could affect the observed outcomes differently.

Thirdly, the sample's inclusion criteria (women with children aged < 12 months) shifted towards a high prevalence of women in a union and very few women who were single or had a previous union. Thus, these results cannot be generalized to other groups of women in the area. Further, given the limited number of separated or widowed women, everyone's prior union categories (separated/divorced/widowed) were merged into one single variable. Notwithstanding, some studies found differences within these categories in indicators such as health behaviour [10], mental health [13], and FI [38]. For instance, in the Krobo society, widowed women are likely to continue receiving the deceased husband's family's support, while divorced women are ostracized from their families, likely adding to their economic burden [39].

Fourthly, there was no information on marital quality indicators, which have been reported in previous studies to explain better health-related outcomes than marital status per se [13]. Finally, although the models attempted to adjust for economic status, these wealth indicators may differ from women's actual financial situation and do not reflect their decision power over their wealth [40]. Likely, the variability explained by this aspect has been underestimated.

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CONCLUSION

The findings of this study highlight the role of women's marital status in nutrition-related indicators in rural Ghana and demonstrate that these associations are context-specific. Although in previous publications, cohabitation is often merged with marriage, these results show that cohabitation does not protect women from food insecurity and poor diets as much as marriage in this rural context. The results also confirm previous findings that marriage improves food security and diet quality but is associated with increased overweight. Moreover, these results show that cohabitating women are in a vulnerable position, especially considering that this type of union is not legally recognized and, thus, these women are not covered by local inheritance rights.

Women's marital status must be considered when developing policies and programs to improve women's high FI, poor diets, and rising overweight. For instance, safety nets or financial assistance programs could provide more benefits to unmarried women (either single or cohabitating) who are not living with their parents or extended families. On the other hand, even though overweight is higher in women than in men, programs that aim to reduce overweight/obesity may be more successful if they target families.

The fact that informal unions are increasing in the country and that a high proportion of women will divorce at some point throughout their lives further stresses the need to understand how marital transition determines health and nutrition in Ghana. Similar trends may apply to other SSA countries. Forthcoming studies could address the mentioned limitations of this research. Ideally, to address this study's objective, data should come from longitudinal cohorts. Given the several possible marital situations in Ghana and other SSA countries, surveys would need to include information on the type of marriage (ordinance, Islamic, customary), bride price payment (amount planned, amount owed/paid), polygamous and coexistence (couples living in the same household). In addition, qualitative studies are needed to understand how marital transition influences women's nutrition-related outcomes.

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Table 1: Characteristics of the sample of rural women in the Upper Manya Krobo District by marital transition

	Continuously married (n=170)	Remarried (n=67)	Single[1] (n=287)	Cohabitating, no previous union (n=339)	Cohabitating, previous union (n=176)
Respondent					
Age group					
≥ 35 y	59 (35.5)[a,b]	32 (49.2)[b]	26 (9.4)[c]	35 (10.6)[c]	42 (25.3)[a]
25 to 34 y	22 (13.3)[a]	4 (6.2)[a]	176 (63.3)[b]	173 (52.3)[b]	44 (26.5)[c]
< 25 y	85 (51.2)[a]	29 (44.6)[a,b,c]	76 (27.3)[b]	123 (37.2)[b,c]	80 (48.2)[a,c]
Ethnicity (Krobo)[2]	115 (67.6)[a]	56 (83.6)[a,b]	244 (85.0)[b]	296 (87.3)[b]	149 (84.7)[b]
Education[3]					
Secondary or higher	65 (38.2)[a,b]	16 (23.9)[b,c]	126 (43.9)[a]	141 (41.6)[a,b]	32 (18.2)[c]
Primary	61 (35.9)[a]	28 (41.8)[a,b]	121 (42.2)[a,b]	139 (41.0)[a,b]	94 (53.4)[b]
None	44 (25.9)[a,b,c]	23 (34.3)[c]	40 (13.9)[d]	59 (17.4)[b,d]	50 (28.4)[a,c]
Income-generating activity					
Farmer	58 (34.1)[a,b]	30 (44.8)[a,b]	50 (17.4)[c]	119 (35.1)[b]	86 (48.9)[a]
Trader	60 (35.3)[a]	28 (41.8)[a]	83 (28.9)[a]	116 (34.2)[a]	58 (33.0)[a]
Other[4]	26 (15.3)[a]	4 (6.0)[a,b]	20 (7.0)[b]	33 (9.7)[a,b]	11 (6.3)[a,b]
None	26 (15.3)[a]	5 (7.5)[a]	134 (46.7)[b]	71 (20.9)[a]	21 (11.9)[a]
Body Mass Index[5]					
Obese	26 (15.9)[a]	8 (12.9)[b]	12 (4.3)[c]	12 (3.6)[c]	8 (4.6)[b,c]
Overweight	53 (32.3)[a]	19 (30.6)[a]	42 (15.1)[b]	51 (15.2)[b]	41 (23.7)[a,b]
Normal	81 (49.4)[a]	32 (51.6)[a]	201 (72.0)[b]	242 (72.0)[b]	109 (63.0)[a,b]
Underweight	4 (2.4)[a]	3 (4.8)[a]	24 (8.6)[a]	31 (9.2)[a]	15 (8.7)[a]
MDD-W[6]	88 (51.8)[a]	27 (40.3)[a,b]	110 (38.5)[a,b]	122 (36.0)[b]	60 (34.3)[b]
Household					
Food Security[7]					
Food Secure	86 (54.4)[a]	24 (41.4)[a,b]	117 (43.7)[a,b]	133 (40.3)[b]	53 (32.3)[b]
Mildly Food Insecure	37 (23.4)[a]	16 (27.6)[a]	70 (26.1)[a]	93 (28.2)[a]	45 (27.4)[a]
Moderately Food Insecure	24 (15.2)[a]	11 (19.0)[a]	42 (15.7)[a]	68 (20.6)[a]	31 (18.9)[a]
Severely Food Insecure	11 (7.0)[a]	7 (12.1)[a,b]	39 (14.6)[a,b]	36 (10.9)[a]	35 (21.3)[b]

https://doi.org/10.18697/ajfand.116.22645

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Wealth – Factor 1[8]					
High	41 (30.1)	21 (33.9)	97 (36.7)	104 (34.0)	46 (27.9)
Medium	44 (32.4)	21 (33.9)	101 (38.3)	88 (28.8)	57 (34.5)
Low	51 (37.5)	20 (32.3)	66 (25.0)	114 (37.3)	62 (37.6)
Wealth – Factor 2[8]					
High	50 (36.8)[a]	23 (37.1)[a]	89 (33.7)[a]	107 (35.0)[a]	42 (25.5)[a]
Medium	38 (27.9)[a]	28 (45.2)[a]	85 (32.2)[a]	108 (35.3)[a]	51 (30.9)[a]
Low	48 (35.3)[a,b,c,d]	11 (17.7)[c,d]	90 (34.1)[a,b,c,d]	91 (29.7)[b,d]	72 (43.6)[a]
Wealth – Factor 3[8]					
High	58 (42.6)[a]	23 (37.1)[a,b]	86 (32.6)[a,b]	102 (33.3)[a,b]	41 (24.8)[b]
Medium	50 (36.8)[a]	25 (40.3)[a]	86 (32.6)[a]	88 (28.8)[a]	59 (35.8)[a]
Low	28 (20.6)[a]	14 (22.6)[a,b]	92 (34.8)[b]	116 (37.9)[b]	65 (39.4)[b]
Household size, (#)	6.7 ± 2.3	6.8 ± 2.0	6.6 ± 2.7	6.7 ± 2.9	6.6 ± 2.5
Children <5 y (#)	1.5 ± 0.6[a]	1.7 ± 0.6[a,b]	1.3 ± 0.5[d]	1.6 ± 0.7[a,b,c]	1.7 ± 0.7[b,c]
Children <18 y (#)[9]	43 (25.3)[a]	36 (53.7)[b]	54 (18.8)[a]	55 (16.2)[a]	85 (48.9)[b]
Dry season[10]	112 (65.9)[a]	47 (71.2)[a,b]	229 (79.8)[b]	206 (60.8)[a]	112 (63.6)[a]

Values are mean ± standard deviation or n (%)

One-way ANOVA test for continuous variables; chi-square test of independence for categorical variables – if p was <0.01, Z-test was done to compare columns. Bonferroni correction method was used to correct α for all multiple comparisons. Letter superscripts within a row indicate whether pairwise comparisons were statistically different

[1]includes 13 respondents whose previous marital status was either separated, divorced, or widowed but were currently in no union. [2]Krobo, the local ethnic group, was compared to other groups (Akan, Ewe, Ga, among others). [3]Highest education level completed. [4]seamstress, hairdresser, among others. [5]Underweight <18.5 kg/m2; Normal 18.5 to < 25 kg/m2; Overweight ≥25 to < 30 kg/m2; Obese ≥ 30 kg/m^2. [6] ≥ 4 of the following food groups: grains and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A-rich fruits and vegetables; other fruits and vegetables in the previous week [24]. [7]Classification based on participants experiences of a 15-item Food Insecurity Experience Scale for the previous 30 days [22]. [8]Household's wealth index tertiles for the first (Factor 1), second (Factor 2) and third (Factor 3) components of a principal component analysis using 12 household characteristics: wall material, water and toilet quality, ownership of poultry, small ruminants, agricultural land, radio, watch, mobile, bank account and number of rooms in the household. Factor 1: strong loading of poultry, small ruminants, agricultural land, toilet, and number of rooms in the household; Factor 2: radio, watch, mobile and bank account. Factor 3: floor and water materials, as well as source of drinking water. [9]woman has children < 18 years who live outside her household. [10]dry season (November to March) compared to wet (April to October)

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Table 2: Association between marital transition of Ghanaian rural women and indicators of their household's food security and their own diet diversity and body mass index

	Food Insecurity[1]		No Minimum diverse diet[2]		Overweight[3]	
	Unadjusted (n=978)	Adjusted (n=855)	Unadjusted (n=1,037)	Adjusted (n=902)	Unadjusted (n=1,014)	Adjusted (n=881)
Marital status[4]						
Cohabitating, previous union	2.50 (1.42, 4.40)***	2.49 (1.31, 4.72)**	2.06 (1.20, 3.53)**	1.82 (0.98, 3.38)†	0.43 (0.24, 0.75)***	0.62 (0.32, 1.19)
Cohabitating, no previous union	1.77 (1.10, 2.85)**	2.01 (1.13, 3.58)*	1.91 (1.20, 3.04)**	1.78 (1.01, 3.12)*	0.25 (0.15, 0.42)***	0.40 (0.22, 0.74)**
Single	1.54 (0.94, 2.52)	1.85 (1.02, 3.38)*	1.72 (1.07, 2.77)*	1.59 (0.88, 2.85)	0.26 (0.15, 0.44)***	0.57 (0.30, 1.09)
Remarried	1.69 (0.79, 3.61)	1.46 (0.64, 3.33)	1.59 (0.78, 3.25)	1.5 (0.68, 3.33)	0.83 (0.4, 1.73)	0.90 (0.39, 2.05)
Continuously married	Reference	Reference	Reference	Reference	Reference	Reference
Age group						
≥ 35 y		1.80 (1.10, 2.94)*		0.97 (0.59, 1.60)		3.72 (2.13, 6.49)***
25 to 34 y		1.60 (1.10, 2.32)*		1.02 (0.70, 1.48)		3.00 (1.90, 4.74)***
< 25 y		Reference		Reference		Reference
Ethnicity[5]						
Krobo				1.79 (1.23, 2.60)**		
Non-Krobo				Reference		
Education[6]						
None				1.81 (1.13, 2.90)*		
Primary				1.42 (0.99, 2.04)†		
Secondary or higher				Reference		
Wealth – Factor 1[7]						
High		0.46 (0.31, 0.69)***				0.56 (0.35, 0.89)*
Medium		0.73 (0.49, 1.10)				0.84 (0.54, 1.31)
Low		Reference				Reference
Wealth – Factor 2[7]						
High				0.44 (0.30, 0.65)***		1.97 (1.25, 3.12)**
Medium				0.68 (0.45, 1.01)†		1.79 (1.12, 2.84)*
Low				Reference		Reference
Wealth – Factor 3[7]						

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High		0.68 (0.46, 1.01)†				1.68 (1.06, 2.66)*
Medium		1.04 (0.70, 1.55)				1.40 (0.88, 2.25)
Low		Reference				Reference
Pseudo R square	0.017	0.055	0.014	0.057	0.060	0.119

† p < 0.1* p < 0.05, ** p < 0.01, *** p < 0.001.

Values shown are odds ratios (95% confidence intervals adjusted using Dunnett's method for multiple groups) from logistic regression models.

[1]participants reported one or more experiences of a 15-item Food Insecurity Experience Scale for the previous 30 days [22]. [2]< 4 of the following food groups: grains and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A-rich fruits and vegetables; other fruits and vegetables in the previous week [24]. [3]Body Mass Index ≥25 kg/m2. [4]single includes 13 respondents whose previous marital status was either separated, divorced, or widowed but were currently in no union. [5]Krobo, the local ethnic group, was compared to other groups (Akan, Ewe, Ga, among others). [6]Highest education level completed. [7]Household's wealth index tertiles for the first (Factor 1), second (Factor 2) and third (Factor 3) components of a principal component analysis using 12 household characteristics: wall material, water and toilet quality, ownership of poultry, small ruminants, agricultural land, radio, watch, mobile, bank account and number of rooms in the household. Factor 1: strong loading of poultry, small ruminants, agricultural land, toilet, and number of rooms in the household; Factor 2: radio, watch, mobile and bank account. Factor 3: floor and water materials, as well as source of drinking water

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