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Dietary diversity and its determinants among Khasi and Garo indigenous women (15 to 49 years) in Meghalaya, northeast India

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Abstract

Background: Despite generally high agrobiodiversity, the Khasi and Garo indigenous people in Meghalaya have poor nutritional status among children and women. **Aim:** To assess the dietary diversity of the Khasi and Garo indigenous women of reproductive age in Meghalaya, while examining the associated factors that affect it and to map the diversity of local food plants. **Methods:** A dietary survey was conducted through 24-hour recall with 276 women from 28 villages of Meghalaya. The mapping of local food plants was conducted through key informant interviews and focus group discussions in the same villages. **Results:** The mean minimum dietary diversity for women is 4.22 (SD $\pm$ 1.26); with one-third (37%) of the women attaining a minimum dietary diversity of five or more food groups in a day. There were significant differences in the dietary diversity among the indigenous groups, the Garo community attaining higher minimum dietary diversity for women. There was also an inverse association between the number of land uses and dietary diversity. The mean number of food plants (including crop varieties) found in each village is 203 (SD $\pm$ 45.7). **Conclusions:** There is potential to enhance dietary diversity through diversifying lesser consumed crops such as vitamin A-rich vegetables and fruits, nuts, seeds and green leafy vegetables in existing land holdings. Also, proper management and access to the commons will provide a sustainable resource base for diet and food security, enhance dietary diversity and bridge the hidden hunger among children and women.

Keywords

Dietary diversity, agrobiodiversity, indigenous food, dietary diversity in Meghalaya, indigenous women, Khasi women, Garo women

Introduction

Over 104 million indigenous people live in India; 12% inhabit the northeastern region of the country. Meghalaya, a state in this region, is largely inhabited (86.1%) by the Khasi (includes *Khynriam*, *Bhoi*, *War*, *Pnar*, *Lyngngam*, *Maram* sub-groups) and Garo indigenous communities (Directorate of Economics and Statistics, Government of Meghalaya, 2017). Meghalaya forms part of the Indo-Burma biodiversity hotspot known for its high species diversity and high level of endemism (Meghalaya Biodiversity Board, 2020). The rich, nutritious and wild edible plants and mushrooms found mainly in the forests are an important source of food for these indigenous communities (Agrahar-Murugkar and Subbulakshmi, 2005; Kayang, 2007; Seal, 2011, 2012). However, there have been changes in the consumption of traditional food in Khasi Hills where the dominance and dependence on common market food is increasing while the consumption of traditional food including wild green edibles and traditional snacks is declining and resulting in poor dietary diversity (Nongrum and Dohtdong, 2018).

Women of reproductive age are particularly vulnerable to *nutritional* deficiencies (Adubra et al., 2019). There is a greater requirement for micronutrients for women from 15 to 49 years due to physiological demands like pregnancy and lactation (Ritchie and Roser, 2017). The Minimum Dietary Diversity for Women (MDD-W) used in this study is a dichotomous indicator of whether or not women

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between 15 and 49 years of age have consumed at least 5 out of 10 defined food groups the previous day or night. The MDD-W indicator is a food group diversity indicator that has been shown to reflect one key dimension of diet quality: micronutrient adequacy (FAO and FHI 360, 2016) .

This study is part of a larger project implemented by North East Slow Food Agrobiodiversity Society (NESFAS) in 105 rural villages in Meghalaya, which aims to diversify diets and enhance indigenous peoples' well-being by agro-biodiversity and traditional foods. As dietary diversity has a strong positive correlation with dietary adequacy and better health outcomes (Kennedy et al., 2007; M'Kaibi et al., 2017), this study aims to assess the dietary diversity of Khasi and Garo women of reproductive age (15 to 49 years) in rural Meghalaya, while examining the associated factors that affect it. An additional aim is to map the diversity of local food plants which will be used by the aforementioned project to diversify the diets of the communities.

Materials and methods

Sampling

The study was conducted in 28 villages of five administrative districts of Meghalaya which were purposively selected from 11 districts of the state. The five districts covered the Khasi (including sub groups) and Garo indigenous communities. There were 11 villages from East Khasi Hills district, four villages from West Khasi Hills district, four villages from West Jaiñtia Hills district, five villages from West Garo Hills district and four villages from Ri Bhoi district. The villages were selected only from the 105 villages where NESFAS has been implementing the project in these five districts. There were two criteria for the selection of the villages: first, there had to be more than 50 households in the village as there would be at least 30 participants in the study from each village; and, second, the proximity of the village to the market as the market influences access to more diverse and nutritious foods available to households, possibly across seasons (Gupta et al., 2020).

As indicated, the purpose of the study was to ascertain the dietary diversity of women of reproductive age (15 to 49 years), estimate the socio-demographic characteristics such as poverty levels as per the Poverty Probability Index and to map the local food plants. Thus, the target participants were women of age 15 to 49 years; 10 of whom were randomly selected from each village for the said purpose. For group discussions and mapping the local food plants, the target group were the key informants who may be above 49 years of either gender but are knowledgeable about the local food plants.

Data collection

Primary data were collected at three levels: key informant interviews, focus group discussions, and individual interviews for 24-hour food recall and estimation of poverty.

Key informant interviews. In our study, key informants (KIs) are custodian farmers knowledgeable about the local food plants of their village. The KI interviews served as a key entry point to understand the food system in the village and aid in creating a list of food plants found in the village. There were 7 to 8 KIs in each village, identified with the help of the headman and by snowballing technique. A total of 213 KIs were interviewed.

Focus group discussions. The focus group discussion (FGD) aimed to confirm or complete the list of food plants created by the KI. The FGD consisted of youth, men and women who were purposively selected. Every FGD was facilitated by a facilitator and a note-taker. FGDs were conducted in all 28 villages and each FGD had between 10 and 15 participants.

24-hour food recall. To determine the dietary diversity of women, the Minimum Dietary Diversity for Women (MDD-W) tool was used to ascertain the dietary diversity of women of reproductive age (15 to 49 years) (FAO and FHI 360, 2016). This was a structured interview to capture detailed information about all foods and beverages consumed by a woman in the past 24 hours. In total, 276 women were interviewed to ascertain the dietary diversity.

Estimation of poverty levels and socio-demographic characteristics. Economic well-being and poverty are known to be influential variables affecting diet and nutrition status. In this study, the poverty levels of the households were estimated using a tool known as the Poverty Probability Index (PPI®). This PPI is a statistically sound poverty measurement tool which uses 10 questions about a household's characteristics and asset ownership of the women. The 10 parameters of the PPI are number of household members, education level of the female head/spouse, possession of assets such as refrigerator, stove/gas burner, cooker/pressure pan, television, an electric fan, an almirah/dressing table, furniture (chair, stool, bench, or table) and motor vehicles (motorcycle, scooter, motor car or jeep) (Schreiner, 2016). The scores were computed for the likelihood that the household is living below the poverty line or above by only a narrow margin. We adopted the India-specific scorecard that has been validated and published in 2016 (Schreiner, 2016). During the individual interview (i.e. 24-hour recall), the PPI interview was also conducted. Besides poverty levels, basic socio-demographic information and land-use profile were acquired.

The data collection was conducted in Khasi and Garo languages by trained graduates between October and December 2018. Interviews and discussions along with observational notes were documented digitally and manually in vernacular languages which were later translated to English.

Data analysis

The primary data collected was analyzed using the IBM Statistical Package for Social Sciences (SPSS) program

Table 1. Socio-demographic profile of research participants.

		District					
		East Khasi	**Garo Hills**	**Jaiñtia Hills**	**Ri Bhoi**	**West Khasi**	**Total**
Number of women (15–49 years)		107	57	33	35	44	276
Ethnicity	**Garo**	0	57	0	0	0	57
	Khasi	107	0	10	30	22	169
	Khasi (Lyngngam)	0	0	0	0	22	22
	Mikir	0	0	0	5	0	5
	Pnar	0	0	23	0	0	23
		107	57	33	35	44	276
Marital status	Divorced	5	0	0	0	0	5
		5%	0%	0%	0%	0%	2%
	Married	84	56	28	27	34	229
		79%	98%	85%	77%	77%	83%
	Single	17	0	5	7	9	38
		16%	0%	15%	20%	20%	14%
	Widowed	1	1	0	1	1	4
		1%	2%	0%	3%	2%	1%
Total		107	57	33	35	44	276
		100%	100%	100%	100%	100%	100%
Education level	Elementary	56	18	12	15	20	121
		52.34%	31.58%	36.36%	42.86%	45.45%	43.84%
	No School	9	4	1	3	3	20
		8.41%	7.02%	3.03%	8.57%	6.82%	7.25%
	High school	30	30	12	9	18	99
		28.04%	52.63%	36.36%	25.71%	40.91%	35.87%
	Senior high school	5	4	5	5	3	22
		4.67%	7.02%	15.15%	14.29%	6.82%	7.97%
	University	7	1	3	3	0	14
		6.54%	1.75%	9.09%	8.57%	0.00%	5.07%
	Total	107	57	33	35	44	276
		100%	100.00%	100.00%	100.00%	100.00%	100.00%
Livelihood type	Labor	53	9	22	12	10	106
		49.53%	15.79%	66.67%	34.29%	22.73%	38.41%
	Not employed	12	0	6	4	9	31
		11.21%	0.00%	18.18%	11.43%	20.45%	11.23%
	Regular job	9	2	2	6	4	23
		8.41%	3.51%	6.06%	17.14%	9.09%	8.33%
	Self-employed	33	46	3	13	21	116
		30.84%	80.70%	9.09%	37.14%	47.73%	42.03%
	Total	107	57	33	35	44	276
		100%	100%	100%	100%	100%	100%

version 23. Data were analyzed using descriptive statistics and chi-square test to test the association of the MDD-W with demographic variables including PPI and number of land uses. The dietary diversity score for women was used as a dependent variable in multiple logistic regression analyses where the variables known to influence MDD-W were included: ethnicity, education, employment, number of land uses and PPI level.

The poverty scores and poverty likelihood were calculated using the guidelines (Schreiner, 2016).The scores were converted using the new R68 scorecard, using 100% national Rangarajan line and also the World Bank international benchmark for extreme poverty of US$1.9 per day per person.

The total number of food plants was ascertained after the KI interviews and FGDs were completed by a simple count of the listed plants. These plants were then categorized into the food groups as described in the MDD-W guidelines (FAO and FHI 360, 2016).

Concerning the data of 24-hour recall, the dietary diversity (DD) of women respondents was determined by a simple count of food groups that the women of reproductive age had consumed over the past 24 hours. Food consumed was then categorized according to the 10 food groups given in the *Minimum Dietary Diversity for Women: A Guide to Measurement*. The 10 food groups are (a) grains, white roots and tubers, and plantains; (b) pulses

Table 2. PPI scores and dietary diversity.

Score	Poverty likelihood (%) (National Rangarajan)	% of Respondents	% reaching MDD-W	Mean dietary diversity score
0–4	76.4	1	0	3.2
5–9	70.9	2	1	3.84
10–14	61.8	4	5	4.07
15–19	51.7	12	12	4.22
20–24	44.6	9	9	4.23
25–29	37.5	11	10	4.36
30–34	31.5	6	5	4.56
35–39	22.9	14	17	4.25
40–44	16.9	9	9	4.23
45–49	11.2	10	8	4.24
50–54	8.0	10	13	4.12
55–59	5.1	3	3	4.49
60–64	3.1	2	1	4.45
65–69	1.8	2	1	4.47
70–74	0.9	2	0	3.92
75–79	0.5	1	1	4.25
80–100 (merged)	0.1–0.0	2	5	4.81

MDD-W: Minimum Dietary Diversity for Women.

(beans, peas and lentils); (c) nuts and seeds; (d) dairy; (e) meat, poultry and fish; (f) eggs; (g) dark green leafy vegetables; (h) other vitamin A-rich fruits and vegetables; (i) other vegetables; and (j) other fruits. The proportion of respondents reaching the MDD-W was calculated, where the cut off for a balanced diet is 5 or more food groups out of 10 (FAO and FHI 360, 2016).

Consent for publication and ethical approval

The study was approved by the Research Committee constituted by NESFAS which included external experts to oversee the study and examine the methodology and ethical standards for compliance in accordance with the Code of Ethics of the Indigenous Partnership for Agrobiodiversity and Food Sovereignty (Indigenous Partnership for Agrobiodiversity and Food Sovereignty, 2011). Before the field survey, the procedure and outcomes of the research were explained to the communities and the free, prior and informed consent was obtained in either a written or oral form.

Results

Socio-demographic profile

To assess the dietary diversity, we interviewed 276 women of reproductive age (15 to 49 years). The mean age of the research participants was 29.92 years (SD $\pm$8.49) and a majority (83%) of the women were married. Considering education level attained, women in Garo Hills (61.4%) showed the highest educational attainment (high school and higher) while women in East Khasi Hills (39.25%) showed lowest educational attainment in terms of completion of high school or higher. The livelihoods are daily wage labor, self-employment (including farming) and regular employment. In Jaiñtia Hills, a large proportion of people (66.67%) are engaged in daily wage labor, and self-employment including farming, was highest (80.7%) in Garo Hills, while women with a regular job were few in all the districts. Table 1 shows the details of the socio-demographic profile of the research participants.

Dietary diversity

The average dietary diversity score (DDS) attained by the respondents is 4.22 (SD $\pm$ 1.26) whereas the MDD-W cut off for dietary adequacy is 5. Only about one-third (37.3%) of the respondents attained a minimum dietary diversity of 5 or more food groups consumed in a day. The Garo women has the highest DD score (4.8) and more than half (60%) of the Garo women had attained minimum DDS while the lowest DDS (3.7) and the lowest number of persons (18%) who have attained MDD-W were observed among the Khasi women in West Khasi Hills.

In this study, the mean PPI score is 38 (SD $\pm$ 18.76) which is associated with a 22.9% probability of the population being below the poverty line. It was also observed that the group of respondents with poor dietary diversity (DDS = 3.2) were linked with the lowest poverty scores (poverty scores 0–4) and the highest likelihood of poverty. On the other hand, the highest dietary diversity (DDS = 4.81) results were observed for the respondents with the highest PPI scores as observed from Table 2.

It was observed that there is an association between ethnicity and MDD-W which is also statistically significant (p-value < 0.01). Also, higher educational attainment seems to be associated with more women who attained the MDD-W although the association is not significant. In the

Table 3. Chi square association of dietary diversity among women of reproductive age.

Background characteristics	% reaching MDD-W[a]	Significance level
Ethnicity		
Khasi/Khasi war	30.18	**
Pnar/Mikir	53.57	
Garo	59.65	
Khasi (Lyngngam)	13.64	
Marital status		
Married	38.43	**
Single	23.68	
Divorced/Widow	66.67	
Education		
No schooling	20.00	NS
Elementary education	36.36	
High school	40.40	
Above high school	41.67	
Employment		
Labor	37.74	NS
Self-employed	43.10	
Not employed	22.58	
Regular job	26.09	
Number of used lands		
No used land	63.64	***
1–3 used lands	27.27	
4–7 used lands	46.72	
PPI level		
60–100	36.84	NS
20–59	38.10	
0–19	37.84	
Total	**37.32 (n=276)**	

***p-value < 0.01, **p-value < 0.05.
[a]Based on 203 observations.
MDD-W: Minimum Dietary Diversity for Women; NS: not significant; PPI: Poverty Probability Index.

Table 4. Determinants of the dietary diversity among women of reproductive age.

Background characteristics	Dietary diversity Odds ratio (95% CI)
Ethnicity	
Khasi/Khasi war	**Ref**
Pnar/Mikir	2.32(0.4–15.3)
Garo	2.94**(1.2–6.8)
Khasi (Lyngngam)	0.44(0.1–1.7)
Marital status	
Married	**Ref**
Single	0.68(0.2–2.2)
Divorced/Widow	5.25*(0.8–33.02)
Education	
No schooling	**Ref**
Elementary education	1.66(0.3–7.4)
High school	1.42(0.3–6.4)
Above high school	1.31(0.2–7.9)
Employment	
Labor	**Ref**
Self-employed	1.23(0.6–2.6)
Not employed	0.46(0.07–3.1)
Regular job	0.57(0.14–2.2)
Number of used lands	
No used land	**Ref**
1–3 used lands	0.03***(0.003–0.33)
4–7 used lands	0.09**(0.007–0.99)
PPI level[a]	
60–100	**Ref**
20–59	0.95(0.30–2.9)
0–19	0.86(0.21–3.4)

***p-value < 0.01, **p-value < 0.05,*p-value < 0.1.
[a]Based on 203 observations.
Ref: reference group; CI: confidence interval; PPI: Poverty Probability Index.

studied communities, land is mainly used for kitchen garden (90%), shifting cultivation or *jhum* (55%), paddy fields (46%) and terrace cultivation (24.6%). In West Garo Hills, land use was mainly for kitchen gardens (98%) and shifting cultivation (93%). It was observed that a large number of people accessed the forests and water bodies such as rivers and lakes and ponds for food. From the natural environment, forests (65%) seem to be most accessible for food or non-timber forest produce but this is not consistent across all regions, as in West Khasi Hills, only 32% of people accessed and used forests. It was observed that 4% of women did not use land for sourcing food but had the highest dietary diversity score (4.6), while 52% of women with 1–3 land uses had a dietary diversity score of 4.0, and 44% of women who managed 4–7 land uses had a dietary diversity score of 4.5. It was observed that there is an inverse relationship between the number of land uses by a household and the dietary diversity, which is statistically significant (p-value < 0.01) as shown in Table 3.

The Garo women had 2.94 times higher odds of attaining MDD-W (odds ratio (95% CI) = 2.94 (1.2–6.8)). In terms of land uses, women with 1 to 3 and 4 to 7 land uses had 0.03 and 0.09 times lower odds of consuming a diversified diet than those with no land use (odds ratio (95% CI) = 0.03 (0.003–0.33); 0.09 (0.007–0.99), respectively) as shown in Table 4.

Food groups consumed

The main food groups consumed are starchy staples (100%), other vegetables (89%) and meat (79%). The low consumption of leafy vegetables, pulses, nuts and seeds, other fruits, eggs and vitamin A-rich plants is evident from Table 5. Consumption of dairy is exceptionally low as generally milk or milk products are not consumed in rural areas.

Biodiversity of local food plants

The mean number of food plants (including crop varieties) found in each village is 203 (SD ± 45.7); Umdum village in

Table 5. Consumption of food groups.

	District					
	East Khasi	Garo Hills	Jaiñtia Hills	Ri Bhoi	West Khasi	Total
Staples	107	57	33	35	44	276
	100%	100%	100%	100%	100%	100%
Pulses	22	23	15	8	5	73
	21%	40%	45%	23%	11%	26%
Nuts and seeds	5	0	6	9	0	20
	5%	0%	18%	26%	0%	7%
Meat	76	50	27	31	34	218
	71%	88%	82%	89%	77%	79%
Eggs	21	7	8	7	4	47
	20%	12%	24%	20%	9%	17%
Leafy vegetables	54	19	18	14	19	124
	50%	33%	55%	40%	43%	45%
Vitamin A rich plants	23	36	5	15	17	96
	21%	63%	15%	43%	39%	35%
Other vegetables	93	54	29	34	37	247
	87%	95%	88%	97%	84%	89%
Other fruits	9	29	7	13	3	61
	8%	51%	21%	37%	7%	22%
Dairy	1	0	1	0	0	2
	0.93%	0%	3%	0%	0%	1%

West Khasi Hills has the least diversity in food plants (124 food plants) and the most diverse village is Khweng in Ri Bhoi with 319 food plants. In terms of the number of food plants in each food group, the mean number of staples is 35 (SD $\pm$ 20.2), green leafy vegetables is 31 (SD $\pm$ 9.6), other vegetables is 52 (SD $\pm$ 16.1), other fruits is 56 (SD $\pm$ 14.9), vitamin A-rich fruits is 9 (SD $\pm$ 3.2), pulses is 5 (SD $\pm$ 3.6) and nuts and seeds is 4 (SD $\pm$ 3.0). These food plants represent the rich agrobiodiversity in each village and remarkably some varieties of each plant-based food groups were available in all villages except for Nongtalang village in West Jaiñtia Hills where starchy staples and pulses were not cultivated. There are three important food groups with lesser diversity in the villages: vitamin A-rich food plants, pulses, and nuts and seeds. Considering the importance of these food groups in reducing micronutrient deficiencies of children and women in the state, it is essential to promote the cultivation and consumption of these foods.

Discussion

In this study, the dietary diversity score among the indigenous women in Meghalaya is 4.22 and only 37.3% of the women attained the MDD-W of five or more food groups. The low dietary diversity score observed in this study is similar to that of the Sauria Paharia indigenous women in eastern India with an average MDD-W of less than five (Ghosh-Jerath et al., 2020). The poor consumption of indigenous food and high prevalence of undernutrition existing among Oroan indigenous women in Jharkhand, East India amid rich knowledge of nutrient-rich indigenous foods (Ghosh-Jerath et al., 2018) is similar to the situation among indigenous women in Meghalaya. Despite the availability of plant foods in the villages, it did not translate to their regular consumption. A report of the 'tribal people', as they are known in India, states that among indigenous women in India, the levels of food intake deficiency and undernutrition are high and almost always higher than in their non-indigenous counterparts (Xaxa et al., 2014). The diets consumed by the indigenous women in Meghalaya are high in starchy staples but largely lacking in green leafy vegetables, orange-colored vegetables and fruits, other fruits, nuts and seeds, and eggs, which may be a contributing factor to the micronutrient deficiency found in Meghalaya among children and women (Chyne et al., 2017; Gonmei and Toteja, 2018; International Institute of Population Sciences, 2015; National Institute of Nutrition, 2006).

It was interesting to see an inverse relationship between number of land uses and dietary diversity. In the recent past, there has been livelihood diversification in rural areas of India to non-farm activities and the share of non-farm income has increased in rural households (Binswanger et al., 2014) which has also contributed to enhanced access to a greater quantity and better variety of food (Rahman and Mishra, 2020). The same is also seen in this study where non-farm income has had a significant positive impact on dietary diversity. While non-farm livelihood activities are essential, it is imperative to enhance the diversity of crop production in the existing land holdings of the indigenous women, as diversity in crop production has been positively associated with the dietary diversity score (Bhagowalia et al., 2012).

The women in Meghalaya also access forests, rivers and lakes, which can be collectively known as the commons. These resources are owned and managed by the village council or *Dorbar Shnong*. The commons are not only a resource base for livelihoods but are also an integral component of the food system of many communities. These are sources of nuts, seeds, green leafy vegetables and fruits, as many are wild species available in the forests that could bridge the existing micronutrient gap. Vira et al. (2015) has elucidated that forest and tree-based systems contribute to the nutritional security of communities and provide the needed micronutrients particularly for children and women. The study by Ickowitz et al. (2016) found that people living close to forests in Indonesia consumed more nutritious foods and in Malawi households located in areas with a high percentage of forest cover had significantly improved vitamin A adequacy (Hall et al., 2019). In Meghalaya, there are unique systems of matriliny and matrilocality where women are custodians of the intergenerational property including land. They play a pivotal role in preserving the rich biodiversity and they preserve the seeds of traditional crops (Ellena and Nongkynrih, 2017). Thus, it is essential to harness the potential of this system and preserve the commons to enhance the dietary diversity of women.

Conclusion

The dietary diversity score among the Khasi and Garo indigenous women (15 to 49 years) in Meghalaya was observed to be often below the minimum dietary diversity score for women with only a third of the women attaining the minimum dietary diversity. This finding will help local government and institutions and enable them to plan relevant intervention programs to enhance dietary diversity. It is important to also conduct further research on Garo women and their ability to attain higher DDS than other ethnic communities in the state. Income from non-farm activities has led to higher dietary diversity among indigenous women. The need is to enhance diversity in crop production in existing land holdings and preserve the commons for enhanced dietary diversity of indigenous women in Meghalaya.

Authors' contributions

MSN contributed to the conceptualization, writing the article, critically reviewed the methodology and also coordinated along with BM the completion of the primary data collection. LP and BM designed the study methodology and analyzed the data. All authors critically revised the manuscript and approved the final version of the paper.

Consent for publication and ethical approval

The study was approved by the Research Committee constituted by NESFAS which included external experts to oversee the study and examine the methodology and ethical standards for compliance with the Code of Ethics of the Indigenous Partnership for Agrobiodiversity and Food Sovereignty (Indigenous Partnership for Agrobiodiversity and Food Sovereignty, 2011). Before the field survey, the procedure and outcomes of the research were explained to the communities and the free, prior and informed consent was obtained in either a written or oral form.

Availability of data

The data that support the findings of this study are available from the corresponding author (MSN) upon reasonable request.

Declaration of conflicting interests

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Supplemental material

Supplemental material for this article is available online.

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