Innovation Lab for Nutrition

Association between production diversity and dietary diversity is sensitive to metrics

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Abstract Number:

Introduction

- Higher production diversity (PD) is associated with improved dietary diversity (DD) in women (WDD) and children (CDD) in certain instances but not all (Mulmi et al 2017, Kissoly et al 2018, Sibahtu et al 2015).
- There are several different methods and/or proxies for computing PD, WDD and CDD (Sibahtu et al 2015)
- Berti et al. 2015 suggest that the association between PD and DD may be modified by the type of metric and the scale for each metric used (either PD or DD or both).
- Given the different definitions for each metric and the need to standardize findings in different contexts, an assessment and comparison of the PD and DD metrics is needed.
- The objective of the study is to empirically test the sensitivity of the association between PD and DD (WDD or CDD) using different computational methods.

Methods

- The analysis utilized data from two rounds (2013 and 2014) of the Policy for Science, Health, Agriculture, and Nutrition (PoSHAN) community studies, a nationally representative panel study in 21 districts (VDC) across 3 agro-ecological zones of Nepal.
- The data included 7783 observations from 4728 households, 5653 children aged 6-59 months old, and 4962 women.
- Production diversity was assessed using the following definitions
  - Total farm species count , including crops and livestock
  - Total food groups produced (8 groups, Mulmi et al. 2017)
- Dietary diversity in women was assessed using the metrics:
  - Food Variety Score (FVS), count of food species consumed
  - Minimum Dietary Diversity Score (10 food groups, FAO and FHI 260. 2016)
- Dietary diversity in children under five was assessed using the following metrics :
  - Food Variety Score (FVS), count of food species consumed
  - Dietary Diversity Score (10 groups, FAO and FHI 260. 2016)
- Multivariate regressions were used to examine the association between PD and DD, controlling for socio-demographic variables, including wealth , farm household, ecological zones, year, woman/child age, VDC.
- We estimated different specification of the model, using combination of different PD and DD metrics. A comparison of the estimates across the specifications was used to determine how sensitive the results were to metrics.

Results

Table 1: Descriptive Statistics

Metrics	Mean	SD	Min	Max
Crop and livestock species produced (PDS)	7.33	6.92	0	35
Food groups produced (PDG)	3.9	2.74	0	8
Child Food Variety Score(7 days) (CFVS)	10.1	4.08	1	37
Child Dietary Diversity (CDDS)	5.86	1.95	1	10
Women's Food Variety Score (7 days) (WFVS)	11.08	3.75	1	28
Women's Dietary Diversity(WDDS)	6.21	1.74	1	10

Table 2: Pearson correlation estimates

Metrics	PDS	PDG	CFVS	CDDS	WFVS	WDDS
Crop and livestock species produced (PDS)	1					
Food groups produced (PDG)	**0.88**	1				
Child Food Variety Score(7 days) (CFVS)	-0.06	-0.1	1			
Child Dietary Diversity (CDD)	-0.1	-0.13	**0.87**	1		
Women's Food Variety Score (7 days) (WFVS)	-0.09	-0.13	0.7	0.63	1	
Women's Dietary Diversity (WDD)	-0.13	-0.16	0.59	0.68	**0.85**	1

Pearson estimates in bold significant at $p < 0.05$

Table 3: Estimated coefficients of association using various combinations of PD-DD

$$Model\ 1:\ DD \sim PD + wealth + farmhh + age + year + VDC$$

	CFVS	CDD	WFVS	WDD
PDS	β=0.0774(t=9.19)***	β=0.0265(t=6.7)***	β=0.0875(t=11.48)***	β=0.0291(t=8.39)***
PDG	β=0.152(t=5.73)***	β=0.0527(t=4.23)***	β=0.204(t=8.49)***	β=0.0743(t=6.8)***

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Sensitivity order of various PD-DD metric combinations (from Model 1)

Sensitivity Order	PD-Child DD	PD-Woman DD
1	PDS-CFVS (9.19)	PDS-WFVS(11.48)
2	PDS-CDD(6.7)	PDG-WFVS(8.49)
3	PDG-CFVS(5.73)	PDS-WDD(8.39)
4	PDG-CDD(4.23)	PDG-WDD(6.8)

t statistics in parentheses

Table 5: Estimated association between PD and DD depends on model specification (e.g. Exclusion of a major explanatory/confounding such as VDC)

$$Model\ 2:\ DD \sim PD + wealth + farmhh + age + year$$

	CFVS	CDDS	WFVS	WDDS
PDS	β=0.0326(t=4.15)***	β=0.00644 (t=1.71)	β=0.0331(t=4.59)***	β=0.00798(t=2.40)*
PDG	β=0.0189 (t=0.78)	β=-0.0067(t=-0.58)	β=0.0426(t=1.91)	β=0.00779(t=0.76)

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusions

- While the scales are different by metric (Table 1), all metrics within each category (e.g. within CDD) have high correlation coefficients (Table 2). We find a robust positive association between PD and DD in both women and children in Nepal irrespective of the type of metric used.
- In assessing the association of PD and CDD, the combination of PDS and CFVS had largest t-statistics, followed by PDS-CDDS, PDG-CFVS, PDG-CDDS while in testing the association between PD and WDD, the combination of PDS and WFVS had largest t-statistics followed by PDG-WFVS , PDS-WDDS and PDG-WDDS (Table 4).
- As noted by Berti et al 2015, different scales does translate into different estimates. We find using species count to measure PD results in larger t-statistics than using food groups to measure PD. Thus these would be more likely have a significant association. (for Nepal data, all were significant.
- Similarly using species count (variety score) to measure DD resulted in larger t-statistics than using food groups to measure DD. Again, these would would be more likely to be significantly associated.
- We find however that the effect on the estimate is more pronounced when a model is mis-specified. Model 2 (Table 5) shows inconsistent estimates of association between PD and DD. We would conclude the association was significant if using PDS and CFVS, but not significant if using other metric combinations
- In conclusion, using different metrics and different scales, we find a positive association between PD and DD. The effect of PD on DD is relatively small but consistent irrespective of the scale of the metric. However using a simple species count (whether for PD or DD) will translate into a larger estimate than using a group count measurement. This is consistent to the finding reported by Sibahtu et al. 2015.
- Such relationships however are likely to be data and context specific.
- As increasing production diversity is promoted as a way to improved dietary diversity, it is important to test alternative PD/DD metrics in order to support such promotion.

References

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