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Animal source food consumption during early childhood is associated with reduced risk of poorer child development outcomes in rural Nepal

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Background:

More than 200 million children <5 years of age in low/middle-income countries are at risk of not reaching their full developmental potential. This deficit has important economic consequences. Multiple factors contribute to this burden, including poor stimulation/learning opportunities, environmental toxins, and nutritional deficiencies, particularly diets deficient in animal source foods (ASF). However, few studies have explored longitudinal associations between household livestock ownership, child ASF consumption, and child development.

Methods:

Child development was assessed using the Ages & Stages Questionnaire (ASQ-3, 3rd edition) in all 307 children age 23-38 months whose families were enrolled in a randomized trial of an intervention implemented over 33 months by Heifer Nepal in Banke, Nepal. Groups included (1) Intensive community development plus nutrition/livestock training ("full intervention") (2) Nutrition/livestock training alone, or (3) Control. Regular household visits were made to administer surveys/conduct child growth monitoring. The ASQ-3 was included in the 3rd visit (15 months after baseline). We used logistic regression to explore longitudinal associations between household livestock score, child ASF consumption (24-hr recall), and total ASQ-3 score in the bottom 25% of the distribution, adjusting for household wealth and maternal education.

Results:

Table 1. Unadjusted associations between ASF consumption, dietary diversity, animal ownership, and risk of poorer developmental outcomes

	Baseline OR (95% CI)	Round 2 OR (95% CI)	Round 3 OR (95% CI)
# ASF eaten by child (past 24 hrs)			
0	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*
1 to 3	0.61 (0.35, 1.06)	**0.50 (0.29, 0.86)**	**0.49 (0.29, 0.82)**
Animal ownership score			
Bottom quartile	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*
Second quartile	0.77 (0.40, 1.48)	**0.47 (0.23, 0.94)**	0.83 (0.41, 1.65)
Third quartile	1.03 (0.47, 2.22)	0.87 (0.42, 1.77)	0.86 (0.44, 1.71)
Upper quartile	0.54 (0.25, 1.16)	**0.26 (0.11, 0.61)**	**0.32 (0.13, 0.68)**
Dietary diversity			
<4 items	**2.30 (1.35, 3.92)**	1.39 (0.81, 2.39)	**1.91 (1.11, 3.28)**
≥ 4 items	*1.00 (ref)*	*1.00 (ref)*	*1.00 (ref)*

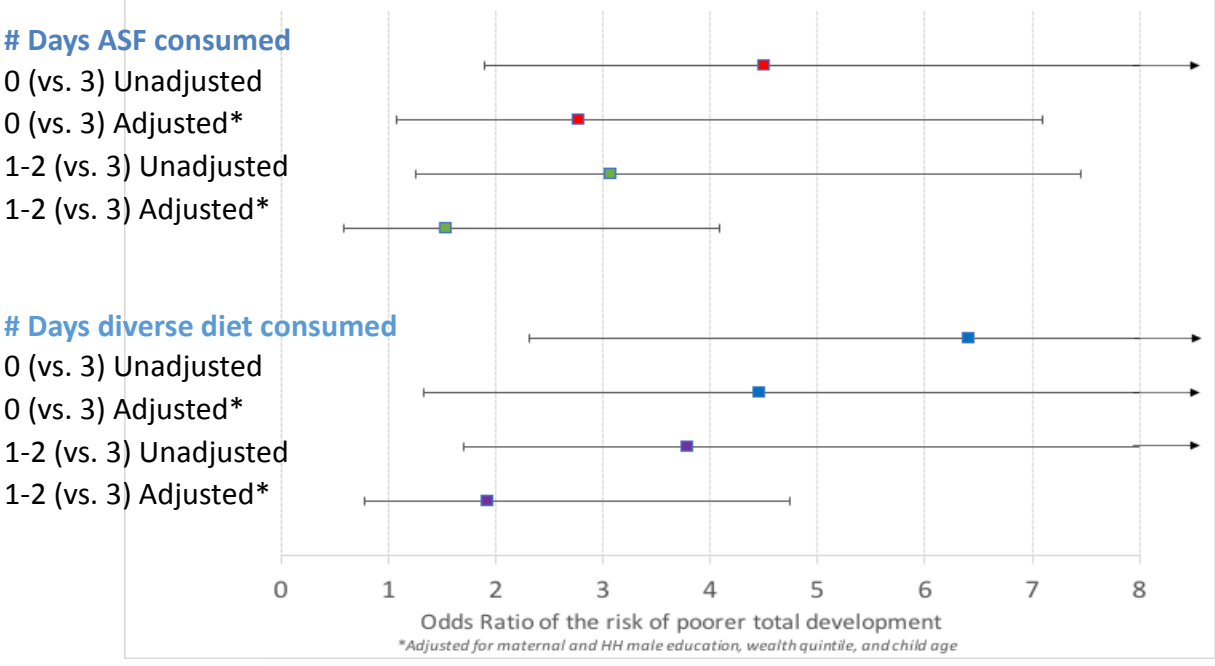
Results in Table 1 Although some variation was observed in associations across rounds, greater child ASF consumption, greater HH ownership of livestock and greater dietary diversity were each associated with lower risk of poor development.

Table 2. Education, wealth, and child factors and risk of poor development outcomes

Maternal Education	
None	**7.62 (1.00, 58.11)**
Some primary	4.27 (0.52, 35.33)
Some secondary/SLC	*1.00 (ref)*
Highest male education in HH	
None	**2.71 (1.19, 6.16)**
Some primary	1.79 (0.75, 4.27)
Some secondary/SLC	*1.00 (ref)*
Wealth score	
Bottom quartile	**3.17 (1.36, 7.42)**
Second quartile	**3.87 (1.67, 8.92)**
Third quartile	2.39 (0.99, 5.74)
Upper quartile	*1.00 (ref)*
Child sex (Girl ref)	1.01 (0.60, 1.69)
Child age (months)	0.96 (0.91, 1.01)

Results in Table 2 Risk factors for poorer total development outcomes included having an uneducated mother, the absence of educated males in the HH, and lower wealth score. Risk of poorer development outcomes decreased with child age, although this association was marginally significant.

Figure 1



Results in Figure 1

- Children who did not consume any ASFs at any of the 3 data collection rounds were 4.5 times more likely to have poorer development outcomes compared to those who consumed ASFs at all 3 rounds.
- Children who met the threshold for minimum dietary diversity at all 3 time points had a significantly lower risk of poor development outcomes compared with those who did not meet it at all or those who met it 1-2 times.
- For both ASF consumption and dietary diversity, adjusting for confounders attenuated the observed associations, resulting in the loss of statistical significance for children who consumed 1-2 times vs. 3 times, but the extreme differences remained statistically significant.

Conclusions:

- Findings of this longitudinal observational study suggest that greater consumption of animal source foods and a diverse diet by children has a protective association with adverse child development outcomes.
- Due to the potential for unmeasured or residual confounding these results should be interpreted with caution.
- Our results are consistent with recent findings from Bhaktapur, Nepal suggesting that poor status of vitamin B12 in early childhood is associated with poorer developmental outcomes (Kvestad, 2017), although there are other nutrients including iron and zinc that could also be plausible explanations for this association.
- The association between indicators of socioeconomic status and the ASQ-3 total scores in this context provides additional evidence of the validity of this tool in the context of rural Nepal.

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