



Photos (clockwise from top left): Maize in Ghana's Upper West Region, which has suffered failed rains and rising temperatures by Neil Palmer/CIAT; Shanti Tamang (19) does her day job, her husband works abroad [Nepal] by Mokhammad Edliadi/CIFOR; Rice threshing, near Sangrur, SE Punjab, India by Neil Palmer/CIAT.

Accelerometry: a practical tool for understanding the role of energy in agriculture-nutrition linkages

RATIONALE

Research on nutrition in low and middle-income countries (LMICs) has mainly focused on how policy and project interventions can bring about changes in diets, while changes in physical activity has been largely overlooked.^{1,2} Productivity-enhancing activities can impact the calorie deficits of the undernourished via their effects on energy intakes and energy expenditure. Rural transformation also has an effect on lifestyles of rural people. Changes in diets and physical activity patterns has a profound effect on livelihoods. The energy expenditure dimension has previously not been incorporated in the analysis of agriculture-nutrition linkages and livelihood analysis.

Most studies capturing energy expenditure in rural households in LMICs have used methods that require a controlled setting. These can be quite expensive and are often very practical for population-level studies.² Accelerometry has advanced in recent years, providing a new opportunity to collect more accurate population-level data on energy expenditure.¹

METHODS

This global research project led by the University of Reading developed a methodology for generating reliable human energy expenditure profiles that can be used in a variety of agricultural settings in developing countries.⁶ Physical activity and energy expenditure data derived from wearable accelerometers is integrated with time use and food intake data

KEY MESSAGES

- Agricultural policies and interventions to enhance productivity and household income can alter how rural communities allocate time and energy to everyday activities.
- Policymakers must consider that interventions affecting time or energy use may have unintended negative effects on households' nutritional status.
- The energy expenditure dimension has previously not been incorporated into analyses of agriculture-nutrition linkages and livelihood analysis.
- Nutrition interventions must explicitly consider the energy expenditure dimension.

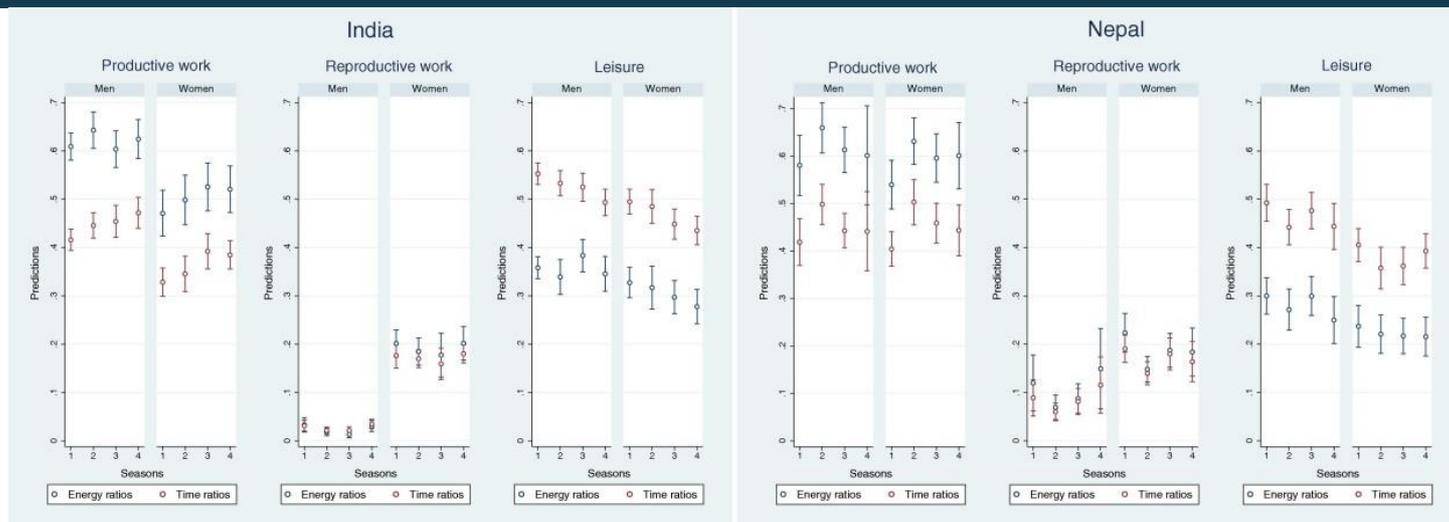


Figure 1. Predicted energy and time ratios for men and women in India and in Nepal by type of activity, gender and season. Notes: Agricultural seasons are numbered as 1 = land preparation, 2 = seeding and sowing, 3 = land maintenance, and 4 = harvesting.⁴

KEY FINDINGS

- Accelerometers offer a noninvasive tool for obtaining energy expenditure data in free-living populations in low- and middle-income countries.
- Men and women both participate in productive work in rural farm households, including crop production and livestock maintenance.
- Productive work accounts for most energy expended by both men and women, while reproductive work accounts for the smallest share.
- Drudgery reduction in rural communities in LMICs has the potential to significantly improve nutritional status.
- Effects of drudgery (energy use intensity) reduction vary by gender and socio-demographic characteristics.
- Bringing together time-use and energy expenditure profiles provides a better understanding of changes in rural livelihoods.

from household and individual surveys in rural settings. The research was carried out in Ghana, India, and Nepal with 120 participants wearing an adapted accelerometer throughout the day for four non-consecutive weeks across an agricultural season.

POLICY AND PROGRAMMING INSIGHTS

The data and methodology developed through this study generated insights into (1) the energy expenditure patterns of rural households and (2) the gender-differentiated intra-household labour and time allocation associated within an agricultural cycle. Such insights are critical for the design of nutritionally-sensitive agricultural interventions. We briefly discuss findings from this research and outline the policy areas and programme interventions that should be addressed.

Reducing drudgery and improving rural welfare³

Our results show that drudgery reduction can have large effects on human energy (calorie) requirements, with an hour of drudgery reduction reducing energy requirements by 11-22% for men and 13-17% for women in Ghana and India. Implications for policy and programming are:

- The substitution of less intense for more intense activities can have large effects on human energy (calorie) requirements;
- Labour-saving interventions have the potential for significant impact on calorie adequacy, even without improvements in food;
- There may be strong case to be made for provision of rural infrastructure on the basis of how they affect energy expenditure and consequently, nutrition outcomes;
- Interventions must be designed to broaden choices that allow improvements of nutrition status through changing physical activity patterns;
- Effects of drudgery reduction vary by gender and socio-demographic characteristics, and these factors must be considered in the promotion of new agricultural technologies.

RESOURCES

- [Field Manual for Practitioners](#)⁶
- Open data available at [UK Data service](#).⁵

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Gender-sensitive agricultural programmes and interventions⁴

Our results show that there are significant gender differences in patterns of time-use and energy expenditure. Men and women participate equally in productive work, however women shoulder most of the reproductive work burdens in rural households at the expense of leisure opportunities. Implications for policy and programme interventions are:

- The design of agricultural interventions should pay attention to how they may impose gender specific demands on energy exertion and time. For example, approaches to increasing women's participation in the cash-earning productive sector are often based on assumptions that there are no trade-offs between income generation activities and the competing demands on women's time and energy expenditure;
- Measuring how people allocate their time and energy expenditure across different activities can improve our understanding of these trade-offs and inform better tailored policies; and
- Interventions that reduce women's daily workload alongside the provision of services that alleviate women's reproductive burden (e.g. childcare, care of the frail and the elderly) can support women to engage in formal and better paid economic activities.

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