



Modernization is associated with intensive breastfeeding patterns in the Bolivian Amazon



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ABSTRACT

For many traditional, non-industrialized populations, intensive and prolonged breastfeeding buffers infant health against poverty, poor sanitation, and limited health care. Due to novel influences on local economies, values, and beliefs, the traditional and largely beneficial breastfeeding patterns of such populations may be changing to the detriment of infant health. To assess if and why such changes are occurring in a traditional breastfeeding population, we document breastfeeding patterns in the Bolivian Tsimane, a forager-horticulturalist population in the early stages of modernization. Three predictions are developed and tested to evaluate the general hypothesis that modernizing influences encourage less intensive breastfeeding in the Tsimane: 1) Tsimane mothers in regions of higher infant mortality will practice more intensive BF; 2) Tsimane mothers who are located closer to a local market town will practice more intensive BF; and 3) Older Tsimane mothers will practice more intensive BF. Predictions were tested using a series of maternal interviews (from 2003 to 2011, $n = 215$) and observations of mother-infant dyads (from 2002 to 2007, $n = 133$). Tsimane breastfeeding patterns were generally intensive: 72% of mothers reported initiating BF within a few hours of birth, mean (\pm SD) age of CF introduction was 4.1 ± 2.0 months, and mean (\pm SD) weaning age was 19.2 ± 7.3 months. There was, however, intra-population variation in several dimensions of breastfeeding (initiation, frequency, duration, and complementary feeding). Contrary to our predictions, breastfeeding was most intensive in the most modernized Tsimane villages, and maternal age was not a significant predictor of breastfeeding patterns. Regional differences accounted for variation in most dimensions of breastfeeding (initiation, frequency, and complementary feeding). Future research should therefore identify constraints on breastfeeding in the less modernized Tsimane regions, and examine the formation of maternal beliefs regarding infant feeding.

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Introduction

Breast milk contains numerous nutritional, immunological, and hormonal constituents that are tailored specifically to infant growth, metabolism, neurocognitive development, and pathogenic challenge (Hinde & Milligan, 2011). Initiation of breastfeeding (herein abbreviated BF) reduces the risk of neonatal mortality (Garcia et al., 2011), and exclusive BF for the first six months of life lowers the risk of infant morbidity across all economic scales (Kramer & Kakuma, 2004). Complementary feeding (herein abbreviated CF), i.e. the provisioning of any non-breast milk solid or liquid, should be initiated around 4–6 months of age to meet the increasing energy demands of growing infants (Dewey, 1997;

McDade & Worthman, 1998; Nielsen et al., 2011). Prolonged BF in conjunction with CF provides continued immunological protection (Dettwyler, 2004; Shiva & Nasiri, 2003) and reduces infant growth faltering (Villalpando & Lopez-Alarcon, 2000), infectious morbidity, and mortality (Lamberti, Fischer Walker, Noiman, Victora, & Black, 2011). Due to these infant health benefits, the World Health Organization recommends exclusive BF for six months, followed by mixed BF and CF for 24 months or beyond (Wagstaff et al., 2006; WHO, 2011). Promotion of increased BF initiation and duration of exclusive and mixed BF are preventative interventions included in the United Nation's Millennium Development Goals to reduce child mortality and eradicate extreme hunger by 2015 (Wagstaff et al., 2006).

A comprehensive review of ethnographic studies shows that the traditional "intensive" BF patterns of most non-industrial populations—widespread BF initiation, infant-driven "on-demand" feeding, sustained periods of exclusive BF, and continued mixed BF

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for up to two years or longer—are largely concordant with current recommendations (Sellen, 2001). In these populations, intensive traditional BF practices may be the most economical, nutritional and hygienic strategy for buffering infant health against the poverty, poor sanitation and limited health care they experience (Anatolitou, 2012; González de Cossio, Escobar-Zaragoza, Gonzalez-Castell, Reyes-Vazquez, & Rivera-Dommarco, 2013; Kramer & Greaves, 2007; Lutter, Chaparro, Grummer-Strawn, & Victora, 2011; McDade, 2005). Biological evidence of infant digestive and masticatory development further suggests that recommended durations for exclusive BF and total BF may be the human ancestral norm (Sellen, 2007).

However, widespread variation in BF practices is evident even among “traditional breastfeeding populations” (Gray, 1995; Piperata & Gooden Mattern, 2011; Vitzthum, 1992). This should be expected as a suite of individual, cultural, economic, and ecological factors ultimately influence individual infants’ needs and individual mothers’ beliefs, perceptions, and constraints (Dettwyler, 1986; McDade & Worthman, 1998). Observable practices in extant traditional BF populations may also be rapidly changing due to outside contact and influences on local economies, values, and beliefs. The effects of such novel influences on the practices and patterns of traditional BF populations remain largely unexplored and, given the diversity of changing BF trends in recent decades, are particularly challenging to project.

The mid-20th century saw the widespread adoption of both bottle-feeding and increased maternal employment outside of the home in many industrialized countries, leading to drastically altered BF attitudes and behaviors, and substantial numbers of infants who were never breastfed or breastfed for only short durations (Boerma, Rutstein, Sommerfelt, & Bicego, 1991; Fomon, 2001; Van Esterik, 2002). Recent global campaigns to promote BF largely seek to reverse these trends. Perhaps due in part to these efforts, BF rates in the U.S. have steadily increased since the 1990s (Pérez-Escamilla & Chapman, 2012; Ryan, 1997; Wolf, 2003), though the former remain well below targeted public health goals (Forste & Hoffmann, 2008; Grummer-Strawn, Scanlon, & Fein, 2008; Pérez-Escamilla & Chapman, 2012). Increased adoption of formula-feeding, shorter BF durations, and the abandonment of traditional BF practices were also observed in many developing populations worldwide during 1980s and 1990s (Adair, Barry, & Guilkey, 1993; Akin, Bilsborrow, Guilkey, & Popkin, 1986; Ferry & Smith, 1983; Guthrie, Guthrie, Fernandez, & Estrera, 1983; Howrigan, 1988; Huffman, 1984; Winikoff, Castle, & Laukaran, 1988). Though BF is currently on the rise in many developing countries (Lutter & Morrow, 2013), less than half of infants in these populations are exclusively breastfed for six months (Marriott, Campbell, Hirsch, & Wilson, 2007). Durations of exclusive BF and total BF have also recently decreased among some vulnerable populations with historically high BF rates, including indigenous populations in Mexico (González de Cossio et al., 2013) and urban populations in Laos (Barennes et al., 2012).

BF patterns of developing populations are continually impacted by changes in maternal education, employment and attitudes and beliefs about infant care — instigated by changing demographics and economies (Abada, Trovato, & Lalu, 2001; Quinlan, Quinlan, & Flinn, 2003; Raphael & Davis, 1985; Rasheed et al., 2009). Historically, the direction and magnitude of change has not been uniform. Changes in BF patterns can be positive; for example in Ghana from 1988 to 1998, mean BF duration increased even as large numbers of women entered the workforce for the first time (DeRose, 2007). Unfortunately, the erosion of traditional BF patterns is more commonly documented as developing populations experience rapid urbanization (Brady, 2012; Gracey, 2003; Harrison et al., 1993; Howrigan, 1988; Igun, 1982; Pérez-Escamilla, 2003; Ruel, Haddad, & Garrett, 1999; Solien de González, 1963).

However, rapid urbanization does not reflect the experience of nearly half of the world’s population (UNDP, 2007). In Latin America and elsewhere, many populations remain relatively non-industrialized, living in rural areas and maintaining traditional subsistence practices such as hunting, gathering, fishing and horticulture (UNDP, 2007). Among these populations “modernizing” influences may affect traditional BF practices differently, as modernization occurs less abruptly in rural, traditional societies than it does in rapidly urbanizing ones.

Modernization entails acculturation, or prolonged exposure to the values, institutions and technologies of a mainstream society (Sam & Berry, 2010). When non-industrialized societies begin to acculturate, subsequent transitions often occur in subsistence, diet, market integration, epidemiology, demography, and formalized education (Coimbra, Flowers, Salzano, & Santos, 2002; Godoy et al., 2007; Malina et al., 2008; Nyberg, 2009; Piperata, Spence, Da-Gloria, & Hubbe, 2011; Valeggia et al., 2010). These transitions often proceed in a prolonged and piecemeal fashion; for example, market foods and modern medicine may become accessible to villages still lacking in basic sanitation and public health infrastructure. While the individual and collective effects of various modernizing influences may not drive linearly predictable changes in traditional BF patterns, any change is likely to influence maternal-infant health outcomes. Ongoing and detailed studies of BF patterns in modernizing traditional populations are therefore crucial, yet research in this area is lacking.

To address this problem, we document the breastfeeding patterns of Tsimane forager-horticulturalists of the Bolivian Amazon. Though the Tsimane remain relatively non-industrialized, access to modern medicine, village schools, and local markets has increased in recent decades (Godoy et al., 2007; Gurven, Kaplan, & Zelada Supa, 2007; Reyes-García et al., 2010). Exposure to these novel influences varies across Tsimane villages, contributing to regional variation in maternal education, maternal-infant health and nutrition, and the adoption of Bolivian national values and traditions. We expect that intra-population variation in Tsimane BF patterns will reflect this regional variation in modernizing influences. Although existing Tsimane subsistence strategies and pathogen exposure (Foster et al., 2005; McDade et al., 2005; Tanner et al., 2011; Veile, Winking, Gurven, Greaves, & Kramer, 2012) should favor the protective effects of intensive BF, we broadly hypothesize that novel modernizing influences will contribute to decreased BF intensity in this population.

In Bolivia and elsewhere in Latin America, national BF rates have risen over the past 20 years, largely due to BF promotion campaigns (Baker, Sane, & Franklin, 2006; Lutter & Morrow, 2013). However, BF statistics derived from national-level surveys often obscure cross-cultural and regional trends, and may not reflect the BF patterns of geographically and linguistically isolated populations such as the Tsimane. For example, in Bolivia the greatest gains in BF have occurred in educated urban women (Lutter et al., 2011; Lutter & Morrow, 2013), whereas the Tsimane reside in a Bolivian region that is overwhelmingly rural, under-educated and poor (UDAPE-UNDP, 2010). Furthermore, for many indigenous Latin American populations, the benefits of health care access and health education are limited due to language barriers (Terborgh et al., 1995). Indeed BF promotion interventions in Bolivia generally are implemented in Spanish, Quechua, and Aymara, which are not spoken by the majority of Tsimane women.

Acculturation and BF patterns

Tsimane women who reside in villages near the town of San Borja (pop ~24,000) are more acculturated than Tsimane women who reside in remote villages. Acculturated Tsimane women have

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