



# Dietary customs and food availability shape the preferences for basic tastes: A cross-cultural study among Polish, Tsimane' and Hadza societies



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## ABSTRACT

Biological significance of food components suggests that preferences for basic tastes should be similar across cultures. On the other hand, cultural factors play an important role in diet and can consequently influence individual preference for food. To date, very few studies have compared basic tastes preferences among populations of very diverse environmental and cultural conditions, and research rather did not involve traditional populations for whom the biological significance of different food components might be the most pronounced. Hence, our study focused on basic taste preferences in three populations, covering a broad difference in diet due to environmental and cultural conditions, market availability, dietary habits and food acquirement: 1) a modern society (Poles,  $n = 200$ ), 2) forager-horticulturalists from Amazon/Bolivia (Tsimane',  $n = 138$ ), and 3) hunter-gatherers from Tanzania (Hadza,  $n = 85$ ). The preferences for basic tastes were measured with sprays containing supra-threshold levels of sweet, sour, bitter, salty, and umami taste solutions. We observed several interesting differences between participating societies. We found that Tsimane' and Polish participants liked the sweet taste more than other tastes, while Hadza participants liked salty and sour tastes more than the remaining tastes. Further, Polish people found bitter taste particularly aversive, which was not observed in the traditional societies. Interestingly, no cross-cultural differences were observed for relative liking of umami taste – it was rated closely to neutral by members of all participating societies. Additionally, Hadza showed a pattern to like basic tastes that are more common to their current diet than societies with access to different food sources. These findings demonstrate the impact of diet and market availability on preference for basic tastes.

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## 1. Introduction

The sense of taste has evolved to serve as a dominant regulator and driver of feeding behavior and physiologically, taste is separated into five basic tastes, each associated with different biological significance; the sweet, salty, bitter, sour and umami (“savory”)

tastes guide the intake of energy (calories), electrolytes, possibly dangerous stimuli, acids and ions, and protein consumption, respectively (Lindemann, 2001). There is evidence to suggest that hedonic responses to tastes, particularly sweetness and bitterness, are present at birth and may be innate (Beauchamp, Cowart, & Schmidt, 1991). Further, biological significance of taste is indicated by evidence for certain, universal food preferences – for example, in most cultures there is a liking for sweet items, though the most liked level of sweetness varies greatly from person to person (Pangborn, 1970).

However, food plays an important part in cultures, not just for

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nourishment, but for establishing traditions (Bessiere, 1998), providing barter for trade, and establishing societal status (Sorokowski, Sorokowska, & Danel, 2013). Additionally, the availability of food plays a role in which food becomes customary to the culture and used for these purposes. For example, people in cultures with access to international trade have a broader diet than societies that have to rely on foods sourced locally or traded regionally (Rosinger, Tanner, & Leonard, 2013). Several implications from these food pressures can not only shape what is eaten in a society, but also the preferences and familiarity for components that make up the flavor of complex food products such as the smell, taste and texture of the food. These preferences might further change the overall perception of the food and contribute to consumption patterns. Generally, food items traditionally consumed in the culture of origin are preferred over other foods (Logue & Smith, 1986; Rozin, 1982). So far, however, only few studies have reported cross-cultural differences in basic taste preferences. An early study by Moskowitz et al. (1975) showed that Indian laborers from the Karnataka region in India who commonly chew on tamarind (a highly sour, but slightly sweet fruit) enjoy sour taste over Western cultures (Moskowitz, Kumaraiah, Sharma, Jacobs, & Sharma, 1975). Later, Prescott and colleagues in a series of studies comparing Australian and Japanese cultures, showed little differences between the societies with regard to taste discrimination or intensities, but varying taste hedonics (Prescott, 1998). The Japanese showed a higher preference for sour and umami than the Australians, reflecting dietary patterns in the cultures. Similarly, this research group showed that domestic products were preferred among the cultures (Laing et al., 1993, 1994).

Overall, biological significance of different food components suggests that preferences for five basic tastes should be similar across cultures. On the other hand, cultural factors play an important role in diet and can consequently influence individual preference for food. To date, very few studies have compared five basic tastes preferences among populations of diverse environmental conditions and dietary customs – research has rather focused on comparing developed societies that have access to foods outside of their culture (Prescott, 1998), or on describing dietary habits of different groups (Berbesque & Marlowe, 2009; Murray, Schoeninger, Bunn, Pickering, & Marlett, 2001). Also, studies rather did not involve traditional populations for whom the biological significance of different food components might be the most pronounced. Hence, it is difficult to draw definite conclusions on cross-cultural basic taste preference patterns and determinants. Thus, this exploratory study looked at differences in basic taste preferences and similarity of these tastes to current diets among three types of populations: 1) a modern society (i.e. Poles), 2) forager-horticulturalists from Amazonia/Bolivia with limited access to modern food (Tsimane'), and 3) traditional hunter-gatherers from Tanzania (Hadza).

## 2. Materials and methods

The study was conducted according to the Declaration of Helsinki. The study protocol and consent procedure received ethical approval from the Institutional Review Board (IRB) of the University of Wrocław (Wrocław, Poland), from the Great Tsimane' Council (the governing body of the Tsimane'), and approved by the Commission for Science and Technology of Republic of Tanzania for Hadza. The participants received small gifts as a compensation for their participation. All participants provided informed consent before study inclusion, either orally (recorded on a portable recorder) or through a signed content form.

### 2.1. Participants

Our comparative study comprised three societies – Tsimane', Hadza and Polish. Tsimane' are a native Amazonian society of farmer-foragers from Bolivia with limited access to international trade (shops with basic foods such as oil, salt, and sugar in San Borja – a Bolivian town that lies between a few hours walk to a few days' canoe trip from Tsimane' settlements). Tsimane' practice domestic farming and agriculture, and several aspects of their culture (e.g. diet, foraging behaviors) have been covered extensively in the literature (Apaza et al., 2003; Foster et al., 2005; Vadez, Reyes-García, Godoy, & Apaza, 2004). Tsimane' tribe consists of roughly 8000 people, from approximately 100 villages located along the Maniqui River in the Beni area in northern Bolivia. This study included individuals from five villages – Campo Bello, Las Palmas, Uvasichi, Las Minas, and Alta Gracia. The Hadza are a traditional hunter-gatherer society from Tanzania who still consume a substantial proportion of traditional foods (95% of calories). They practice no cultivation or domestication of plants or animals, and their diet can be broken down into five major food categories: honey, meat, berries, baobab, and tubers (Marlowe, 2010; Schoeninger, Bunn, Murray, & Marlett, 2001; Vincent, 1985). Their population consists of 1000–1500 individuals who live in mobile camps of approximately 30 people. They live near Lake Eyasi, in northern part of Tanzania. For more information on traditions of this society, see e.g., (Marlowe, 2010). Polish individuals represented a Western society with full access to international trade.

One hundred and thirty-eight Tsimane' (70 women) with an age range from 18 to 72 (mean age  $\pm$  SD = 32.48  $\pm$  12.12 years) participated in the study. Further, eighty-five (40 women) individuals from the Hadza society were included in the study with an age range from 18 to 70 (33.70  $\pm$  14.15 years). The Polish sample consisted of 200 individuals (100 women) with an age range from 18 to 68 (32.63  $\pm$  12.57 years).

### 2.2. Procedure

All tests among all the groups were carried out by a trained experimenter while an interpreter explained the procedure to all participants in their native language. Each participant was examined individually, and no major health issues were reported during testing. Participants from traditional societies had to confirm with the interpreter that they understood the procedure before moving forward with testing.

All five basic tastes were tested using sprays bottles containing each basic taste dissolved in water (up to 100 mL) at suprathreshold levels: sweet (10 g D-saccharose), sour (5 g citric acid), salty (7.5 g NaCl), bitter (0.05 g quinine hydrochloride), and umami (10 g monosodium glutamate; MSG). The participants were asked to open their mouth with their tongue extended while the administrator applied one spray (0.120 ml) over the tongue surface. The presentation order of basic tastes was the same for all participants (sweet, salty, sour, umami, bitter), and in between samples, participants were asked to rinse their mouth with clean water. After each taste spray, participants were asked three questions. First, they were asked if they were familiar with the taste (yes or no), and further – how good the taste was. Polish and Tsimane' participants were provided with the following response options: "I like it a lot", "I like it", "It is neutral", "I do not like it", or "I do not like it at all"; and Hadza answered this question on a following scale: "I like it", "It is neutral", or "I don't like it". Finally, all groups were asked to rate similarity of a certain taste to their diet ("Do you eat food that tastes similar to this spray?") with the following response options: "No", "Sometimes", "Every day", or "A few times a day". The shorter scale was used for Hadza in the liking task since their ability

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