



## Research report

# Influence of sensory and cultural perceptions of white rice, brown rice and beans by Costa Rican adults in their dietary choices <sup>☆</sup>



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## ABSTRACT

Little is known about the distinct perceptions towards rice and beans that may shape the consumption of these main staple foods among Costa Ricans. We aimed to identify barriers and motivators that could change the current staple into a healthier one, and assess the sensory perceptions of these foods in this population. Focus group discussions and sensory tastings of 8 traditional white or brown rice and beans preparations were conducted in 98 Costa Ricans, aged 40–65 years. Traditional habits and family support emerged as the two main drivers for current consumption. Consuming similar amounts of rice and beans, as well as unfamiliarity with brown rice, are habits engrained in the Costa Rican culture, and are reinforced in the family and community environment. Suggested strategies for consuming more brown rice and more beans included introducing them during childhood, disseminating information of their health benefits that take into account the importance of tradition, lowering the cost, increasing availability, engaging women as agents of change and for brown rice masking the perceived unpleasant sensory characteristics by incorporating them into mixed dishes. Plain brown rice received the lowest mean hedonic liking scores. The preparations rated highest for pleasant were the beans: rice 1:1 ratio regardless of the type of rice. This study identified novel strategies to motivate Costa Rican adults to adapt their food choices into healthier ones within their cultural and sensory acceptability.

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## Introduction

Rice is a main staple food in many countries, with Asia, Latin America and the Caribbean comprising the top producers and consumers of such commodity (Kennedy, Burlingame, & Nguyen, 2002). White rice is the primary type consumed, whereas hulled or brown rice is rarely consumed. This is partly due to manufacturing practices, as over 65% of the global paddy rice undergoes extensive industrial processing, including milling and polishing, to convert it into polished white rice (Kennedy et al., 2002). Thus, the bulk of

the rice available for consumption as white rice is depleted of the essential vitamins, minerals, protein, and fiber contained in the outer layers of the grain, which are removed during the industrial process (Calpe, 2006). The level of processing increases the glycemic index of white rice, i.e. its ability to raise postprandial blood glucose levels (Foster-Powell, Holt, & Brand-Miller, 2002).

Throughout generations, people in many Latin American and Caribbean countries have traditionally eaten white rice with legumes (Barbosa, 2012; Houston, 2005; Janer, 2008; Noel, Newby, Ordoñez, & Tucker, 2009; Rodrigues, da Costa Proença, Calvo, & Fiates, 2013), a combination that restores adequate protein and fiber intake. However, the global demand for white rice has been rising while consumption of legumes has decreased since the 1960s. In Latin America and the Caribbean, the contribution of milled white rice to energy increased by 28% from 12–30%, while the intake of legumes has remained stagnant between 3 and 4% (Akibode & Maredia, 2011; Kennedy et al., 2002). The particular situation of Costa Rica epitomizes the global trends. White rice and beans (predominantly black beans) comprise the base of many meals in Costa Rica usually supplemented with another side dish (Janer, 2008). According to FAO data, Costa Rica was classified as a “high rice consumer” in 1999 (Nguyen,

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2002). The per capita rice supply was 170 g/person/day, equivalent to a contribution of 640 kcal/person/day, and representing an exponential growth rate of 12% in just 4 years. On the other hand, a 46% reduction in bean consumption has been reported in Costa Rica in a period of 30 years (Rodríguez-Castillo & Fernández-Rojas, 2003).

The opposing trends in consumption of white rice and legumes raise concern in light of the steep increase in the global prevalence of diabetes and related chronic disease (Hu, 2011; Noel et al., 2009). Recent epidemiological studies show that higher intake of white rice is associated with increased risk of type 2 diabetes (Hu, Pan, Malik, & Sun, 2012; Nanri et al., 2010; Sun et al., 2010; Villegas et al., 2007), while substituting it for brown rice is associated with lower risk (Sun et al., 2010). On the other hand, increased intake of legumes has been associated with prevention of type 2 diabetes, heart disease, obesity, high blood pressure, and cancer (Bouchenak & Lamri-Senhadji, 2013; Curran, 2012). One of our studies in a Costa Rican adult population showed that intake of a higher ratio of beans to white rice, or replacement of one serving of white rice for one serving of beans, was associated with lower prevalence of components of the metabolic syndrome (Mattei, Hu, & Campos, 2011). Together, these studies suggest that consuming brown instead of white rice and increasing the intake of legumes may improve the cardiometabolic profile and reduce the risk of diabetes. In order to create potential strategies to encourage such dietary changes, it is essential to understand the factors that may drive, and potentially sway, the behaviors, choices, and preferences related to intake of white rice, brown rice, and legumes.

Urbanization, higher income and education, and modern unhealthy lifestyles have been associated with lower legume and higher processed food consumption (Caballero, Allen, & Prentice, 2012; Kabagambe, Baylin, Ruiz-Narvarez, Siles, & Campos, 2005; Popkin, Adair, & Ng, 2012; Uauy & Monteiro, 2004), but little is known about the distinct perceptions and attitudes toward rice and legumes that could influence their consumption. A few recent qualitative studies across various cultural groups have suggested potential factors that may facilitate or hinder increased intake of brown rice or legumes. In India, tradition, differences in cooking and sensory qualities were considered the main reason for choosing white over brown rice (Kumar et al., 2011; Vasudevan et al., 2013). Sensory perceptions of brown rice (rough texture and unpalatable taste) were also rated mostly positive among Tanzanian obese adults (Muhithi et al., 2013), but not among Chinese adults (Zhang et al., 2010). Main barriers for consumption of brown rice among Indians were lack of awareness about its nutritive properties and perceived inferiority (Kumar et al., 2011), while for Chinese adults the barriers were inferior taste, quality, and price (Zhang et al., 2010). There are fewer studies for legumes consumption in Latin America, but a survey among Puerto Rican adults revealed taste and nutrition as the main reasons for consuming them (Mattei & Campos, 2014). Earlier studies are methodologically comparable, thereby indicating that culture pervasively underlies all food choices.

The previous studies collectively suggest that there are opportunities to improve the diet, and possibly health status, of each population using local staple foods. But the studies also highlight peculiarities across cultures, and any potential dietary intervention or program to promote healthy eating should consider these cultural intricacies in order to enhance its success. To date, there are no studies on the cultural and sensory perceptions of rice and beans in Costa Rica. Also, little is known about which factors may enable or prevent acceptance of brown rice as a substitute of white rice, or of an increased ratio of beans in the common combination. In response, the aim of this study is to identify barriers and motivators that could influence changes in current consumption of these staple foods to a healthier one, and assess the sensory perceptions of brown rice and beans in the traditional combinations

among Costa Rican adults, using focus group discussions and food sensory tastings.

## Materials and methods

### Study sample

The study was conducted from February to November, 2012 in two rural zones (San José de la Montaña and Llano de Grande) and two urban zones (Moravia and Desamparados) within the Great Metropolitan Area of Costa Rica, where the largest percentage of the Costa Rican population resides (Instituto Nacional de Estadística y Censos (Costa Rica), 2011). The study was advertised through flyers distributed by community leaders (i.e. church priests and ministers, development agencies, and teachers). Participants had to be aged 40–65 years and free of major non-communicable chronic diseases (i.e. hypertension, type 2 diabetes, cancer, or cardiovascular disease). The latter exclusion criterion was included to reduce some bias in the responses, as each person may perceive or define certain experiences based on their health status.

The Costa Rican Institute for Research and Education on Nutrition and Health (INCIENSA, Spanish acronym) and Harvard University Institutional Review Board for Human Research approved the study. All participants provided written consent and were given the opportunity to ask any questions about the study or the consumption of white or brown rice, and beans, which were all clarified. No monetary incentives or reimbursements were provided. All participants received a complimentary copy of the Dietary Guidelines for Costa Ricans at the end of the study.

### Questions and implementation of the focus group discussions

On the day when the focus group was scheduled, prior to starting, height and weight were measured in duplicate in all participants to estimate BMI (kg/m<sup>2</sup>). Each participant was asked to complete a self-administered questionnaire on socio-demographic characteristics. The focus groups were homogeneous with respect to sex, BMI status ( $\leq 25$  or  $> 25$ ), and residential area (urban or rural); i.e.: men and women, low and high BMI, or rural and urban were not combined in a group. A total of 16 focus groups were conducted with six to eight participants each. Each focus group consisted of three sessions conducted sequentially on the same day. Two focus group sessions were held before performing the food sensory tastings, and the third focus group session was held after this.

Each session specifically discussed: (1) barriers and motivators for eating higher proportion of beans to white rice, based on its association with lower odds of cardiometabolic risk factors (Mattei et al., 2011), (2) barriers and motivators for eating brown rice instead of white rice, and based on its association with lower risk of diabetes (Sun et al., 2010), (3) perception of the sensory characteristics of food preparations that included white or brown rice with and without black beans at various ratios. The three sessions of each focus group, including the tastings, were carried out with the same participants throughout, with no attrition. Each focus group was audio-recorded, and was facilitated by a trained Spanish-speaking moderator, with assistance of a co-moderator.

Before starting the first focus group session, participants were shown samples of 7 food preparations with beans: rice ratios of 0.5:1, 1:1, 1:2, 1:0.5, 1:3, 2:1, 3:1. Subsequently, they were asked to write down the ratio that most closely resembled the one that they usually consumed and briefly describe the reason for their selection. This was followed by the first session using a guideline of questions developed by the research team to examine each topic in depth. Each session ended once data saturation was reached. Examples of the questions for the first two sessions include:

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