



The Ancestral Human Microbiome:

From Traditional Production and Consumption to the Impact of Modern Practices in Nutritional Health among Amazonian peoples

María Gloria Domínguez-Bello and Hortensia Caballero-Arias

NYU School of Medicine, New York Venezuelan Institute for Scientific Research (IVIC), Caracas







Temporal trend of diseases in developed countries



Bach 1999

Obesity trends



Source: CDC Behavioral Risk Factor Surveillance System



Short Report

The Nutrition Transition in the Venezuelan Amazonia: Increased Overweight and Obesity with Transculturation

G. HIDALGO, ^{1,2} E. MARINI, ³* W. SANCHEZ, ² M. CONTRERAS, ⁴ I. ESTRADA, ⁵ O. COMANDINI, ³ R. BUFFA, ³ M. MAGRIS, ¹ and M.G. DOMINGUEZ-BELLO^{6,7,8}

¹Amazonic Center for Research and Control of Tropical Diseases (CAICET), Puerto Ayacucho, Amazonas, Venezuela

²Division of Biological Sciences, FUNDACREDESA, Caracas, Venezuela

³Department of Environmental and Life Sciences, University of Cagliari, Cagliari, Italy

⁴Center of Biophysics and Biochemistry, Venezuelan Institute for Scientific Research (IVIC), Caracas, Venezuela

⁵Mision Barrio Adentro 1, Ministry of Health, Pto Ayacucho, Amazonas, Venezuela

⁶Department of Medicine, New York University School of Medicine, New York, USA

⁷Department of Biology, University of Puerto Rico, San Juan, Puerto Rico

⁸Colaborador Visitante, Center of Biophysics and Biochemistry, Venezuelan Institute for Scientific Research (IVIC), Caracas, Venezuela



Glida Hidalgo, CAICET Monica Contreras, IVIC Magda Magris, CAICET



Fig. 1. Bioimpedance vector analysis (BIVA) of 37 adults from Mahecoto, Platanillal, and Coromoto villages. (\bigcirc) Mahecoto (n: 7), (\bigcirc) Platanillal (n: 13) y (\bigwedge) Coromoto (n: 17).

Consequences of modern urban practices





Antibiotics lead to increased fat deposition



>50 years of antibiotic use for growth promotion





The microbiome is the interface between the exterior and our human cells

Human development and natural exposures



Human development and *decreased* natural exposures



Diseases associated with C-section



Type 1 diabetes Algert, McElduff et al. 2009

Aumeunier, Grela et al. 2010 Bonifacio et al. 2012

Celiac disease

Decker, Engelmann et al. 2010 Marild, Stephansson et al. 2012

Asthma

Kero, Gissler et al. 2002 Kero et al. 2002 Thavagnanam et al. 2007 Roduit et al. 2009 Couzin-Frankel 2010 Ege et al. 2011 Azad et al. 2012

Obesity

Huh, Rifas-Shiman, et al. 2012 Blustein et al. 2013 Mueller et al 2014

Delivery mode and the primordial microbiota

C-section

- Acinetobacter
- Bacillales
- Coriobacterineae
- Corynebacterineae
- Haemophilus
- Lactobacillus
- Micrococcineae
- Neisseria
- Pasteurellaceae
- Prevotella
- Propionibacterineae
- Sneathia
- Staphylococcus
- Streptococcus
- Other



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Vaginal





Dominguez-Bello et al. PNAS 2010

Sci Translat. Medicine, 2016 Antibiotics, birth mode, and diet shape microbiome maturation during early life

Nicholas A. Bokulich,¹ Jennifer Chung,¹ Thomas Battaglia,¹ Nora Henderson,¹ Melanie Jay,^{1,2} Huilin Li,³ Arnon D. Lieber,¹ Fen Wu,^{1,2} Guillermo I. Perez-Perez,^{1,4} Yu Chen,^{1,2} William Schweizer,⁵ Xuhui Zheng,⁴ Monica Contreras,¹ Maria Gloria Dominguez-Bello,¹ Martin J. Blaser^{1,4,6}*













Ecological consequences of compounded impacts



Robert Paine 1933-2016



The *urbanite* microbiome







Fecal microbiome alpha diversity across cultures



Oscar Noya CAICET



Jose CLemente Mount Sinai SM



Rob Knight,

UCSD





Clemente et al. 2015 Science Advances

Gut bacterial taxa under extinction?



Clemente et al. 2015 Science Auvances

Consequences of modern urban practices



Obesity, Autism, Altzheimer



How the ways of life of indigenous peoples in the Amazon contribute to a more diverse microbiome?

What can we learn from Yanomami foodways and sustainable diets?







Foodways and sustainable diets

Foodways

The modes of feeling, thinking and behavioring about food that are common to a cultural group (Jack Goody, 1982)









Sustainable Diets

Are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. (FAO, 2010).

Also:

- Protective of biodiversity,
- Culturally acceptable,
- Economically affordable
- Nutritionally adequate,
- Safe and healthy (FAO, 2010).

Yanomami indigenous people and their habitat



Yanomami Population

- Total population: 34,567
 - Yanomami in Venezuela: 15,229 (2011)
 - Yanomami in Brazil: 19,338 (2011)
- Area of occupancy in the Amazon rainforest: 190,000 km2 in Brazil and Venezuela
- Their village (*shapono*) contain between 20 and 300 native people. There are around 200 *shapono* in Venezuela.
- The *shabono*, a collective housing, constitutes the perimeter of the village.
- From the rainfores*t (urihi)* they obtain the means for their subsistence.



Yanomami subsistence activities



When the Yanomami are hungry

- Ya ohi
 - "I am hungry", in general



- Ya naiki
 - "I am hungry of game or fish" (protein)



Agriculture

Preparing the garden (*hikarimou*)







Slash and burn



Plantain trees (Musa paradisica) Kuratha





Manioc or cassava (*Manihot esculenta* Cranz) Nashi



Agriculture

Technics	 Slash and burn of gardens Shifting cultivation Steel tools
Crops	 Plantains and bananas Manioc or cassava Papaya Taro Sweet potatos
Cooking	 Boiled Roasted in the hot coals of the hearth On a griddle
Food	 Roasted and bolied plantain Casabe bread Mañoco (toasted flour) Variety of fruit pulp

Hunting







Hunting

Technics	 Bow and arrow Shotgun Types: <i>rami huu</i> and <i>heniyomi huu</i>
Game	 Large game birds Wild pigs Monkeys, tapir, armadillos, alligators, deer, rodents
Cooking	• Roasted • Smoked • Boiled
Food (protein)	 Roasted, smoked and boiled a variety of animal food

Fishing

















Fishing (yurimou)

Technics	Fish hooks and nylonNets and basketsBuoys
Fish	•Yaraka •Pavon •Bocon •Rayado
Cooking	•Boiled •smoked
Food	 Roasted, smoked and boiled a variety of fish
(Protein)	



Gathering



Gathering

Technics	Collecting
Crops	Palm fruitHoneyFat palm-pith groups
Cooking	BoiledRoasted
Food	 Palm fruits Honey Insects

Relationship between traditional cultures and a more diverse microbiome



Conclusions

 Traditional cultures harbor a more diverse microbiome than in peoples living in industrialized societies

 The challenge is the future use of sustainable diets and lifestyles that does not increase the risk of inflammatory and metabolic diseases.