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Making a Maradona: Meat Consumption and Soccer Prowess[*]

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Abstract

We provide novel evidence that poor individuals born in countries with high consumption of meat are more likely to show soccer prowess. Our findings are robust to controlling for population, per capita income, and interest in soccer. We posit that the combination of relatively cheap meat and low opportunity costs of engaging in a career in professional soccer can explain this association between meat consumption, low socioeconomic status, and soccer prowess. Access to cheap meat implies a higher quality diet, which allows for the development of the cognitive functions required to excel in soccer. Poverty implies a low opportunity cost of putting those improved cognitive functions to use in soccer.

Keywords: Sports; Meat consumption; Soccer; Nutrition; Poverty; Cognitive functions.

JEL classification: Z20; Z22; J22; J24.

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1. Introduction

What do Maradona, Pelé, Messi, Cristiano Ronaldo, and Cruyff have in common, other than being consistently ranked amongst the best soccer (association football) players of all times? They were all born and raised in countries of high per capita consumption of meat, within low-income, working-class households. The central tenet of this paper is that this is not a coincidence.

We posit that the combination of relatively cheap meat and low opportunity costs of engaging in a career in professional soccer can explain the association between meat consumption, low socioeconomic status (SES), and soccer prowess. Being raised in a country where meat is relatively cheap implies that, even if poor, individuals have easier access to a high-quality diet, crucial for the development of the brain, in general, and of the cognitive skills required to excel in soccer, in particular. Being relatively poor, on the other hand, means that the opportunity cost of pursuing a career in professional soccer is relatively low (see Rossi and Ruzzier, 2018, for related evidence and a model of career choices).

Soccer is indisputably the most popular sport in the world. According to the 2006 Big Count, a FIFA survey of its 207 member associations, 265 million players (professional, registered, and occasional) were actively involved in this sport (Rossi and Ruzzier, 2018). Soccer is also the number one sport for global audience, TV viewers, internet popularity, number of professionals, market value (Marchiori and De Vecchi, 2020), and research (Reilly et al., 2000). As in many other domains, the key resource in soccer is talent (Kuper and Szymanski, 2014), and identifying talent is of crucial importance to the multi-million-dollar business soccer has become (Morris, 2000; Williams and Reilly, 2000).

We begin by unpacking the main ingredients of the meat-brain-talent argument above. Next, we produce aggregate (i.e., country-level) quantitative evidence of a robust, positive correlation between meat consumption and soccer talent (measured by the number of players, born in the country, nominated to the *Ballon d'Or* in 2016-19), conditional on wealth, size, and interest in soccer. Last, we go down to the individual level of the most talented players, and look at their personal life stories to classify players along the two dimensions of interest: SES of the family and meat consumption. We find that a disproportionate fraction of the most talented players does come indeed from low-SES households in high-meat-consumption countries. In the concluding section, we provide some final thoughts.

2. You play how you eat: the underappreciated link between meat, mind, and soccer prowess

While it is undisputed that performance at the elite level in professional soccer requires superior physical abilities and motor coordination, there is also a recent surge of interest in the cognitive (and creativity-related) processes that are important for soccer, as physical skills and coordination alone have been shown to have a low predictive value (Vestberg et al., 2012; 2020). Executive functions – a family of top-down mental processes needed for the cognitive control of behavior (Diamond, 2013) – have been associated with talented soccer players, even after controlling for training hours and competitive level (see Voss, 2010; Vestberg et al., 2012, 2017, 2020; Wright et al., 2013; Verburgh et al., 2014; Huijgen et al., 2015; Memmert, 2017; Fink et al., 2018; Scharfen and Memmert, 2019). Moreover, superior executive functioning predicts success in the sport (Vestberg et al., 2012; 2017; 2020; Sakamoto et al., 2018; Scharfen and Memmert, 2021).

Executive functions include core functions – such as working memory, cognitive flexibility, and inhibitory control – and higher-order functions – like reasoning, problem solving, and planning (Diamond, 2013). All of these cognitive abilities are required in soccer; actually, executive functions are regularly called "game intelligence" in that context (Vestberg et al., 2017; Sakamoto et al., 2018). In an open skill sport like soccer, successful players are required to react in a dynamically changing, unpredictable, and externally-paced environment (Huijgen et al., 2015), by making fast decisions that need to be constantly reevaluated depending on the circumstances (Vestberg et al., 2017). Inhibitory control and cognitive flexibility are key to this ability to adapt quickly to new demands in the face of rapidly changing situations (Huijgen et al., 2015). Working memory, on the other hand, may be useful for choosing positions and mentalizing possible options in the game (Verburgh et al., 2014).

Executive functions are also closely linked to creativity (Diamond, 2013). Successful solutions in soccer are "often original and surprising, characterized by the flexible production of novel, unexpected passes, and moves" (Fink et al., 2018: 1), and the evidence shows that creativity is a key factor for success in soccer (Kempe and Memmert, 2018; Roca et al., 2018; Rominger et al., 2021).

While adequate nutrition is important for normal brain development (Prado and Dewey, 2014) in general, the role of nutrition in the development of these cognitive functions, in particular, has been the focus of much behavioral work recently (Wainwright and Colombo, 2006). The cumulating evidence points in the direction of a positive association between food quality and executive functioning (see the review by Cohen et al., 2016). Growing evidence also associates early-life undernutrition (like protein-energy malnutrition, or micronutrients deficits such as iron deficiency anemia) with permanent negative effects on cognitive skills, likely supporting a causal effect (Bryan, 2004; Engle et al., 2007; 2011; Grantham-McGregor et al., 2007; Walker et al., 2007; Hoddinott et al., 2008; 2013; Isaacs et al., 2008; Victora et al., 2008; Maluccio et al., 2009; Macours et al., 2012; Puentes et al., 2016; Cheatham, 2019). Early childhood is a crucial period for the development of cognitive functions, since the brain develops most rapidly at this stage (Huttenlocher, 1979; Georgieff, 2007; Gertler et al., 2014; Bolbocean et al., 2018; Li et al, 2021).

Meat is a high-quality food, as it is an excellent source of readily digested protein, energy, and micronutrients like iron, zinc, and vitamins of the B group. Improving access to and utilization of meat and other animal source foods has been advocated as a sensible way of promoting social and economic development (Neumann et al., 2002). Increased consumption of meat early in life has been shown to improve cognitive performance, both in childhood and later in life (Sigman et al., 1989a; 1989b; 1991; Neumann et al., 1992; 2003; 2007; Whaley et al., 2003, Gewa et al., 2009; Hulett et al., 2014) – even after controlling for SES factors and schooling.

Low SES correlates with low-quality diets because, among other things, poor households are priced out from high-quality foods like meat (Neumann et al., 2002; Woldemichael et al., 2022), which are regarded as too expensive. Poverty, actually, is the top reason given for the absence of meat in the diet (Neumann et al., 2002). Access to relatively cheap meat can mitigate the negative impact of low SES on cognition, and this is more likely when poor households are located in a country where meat is relatively inexpensive.

Finally, cognitive functions are necessary for soccer talent, but talent must also be found, developed, and nurtured (Kuper and Szymanski, 2014). Many factors mediate this process. Money, know-how, infrastructure (all arguably related to a country's wealth), country size (since more populous countries tend to have a larger supply of talented people), and interest in soccer in the country are natural candidates (see, e.g., Kuper and Szymanski, 2014; The Economist, 2018). We wish to emphasize here a previous step: talent must be applied to soccer to be developed and eventually manifested. Put differently, professional soccer is a career choice.

In choosing careers, opportunity costs are a paramount consideration (Rossi and Ruzzier, 2018). Individuals from low-SES households arguably have lower opportunity costs, and actually most of the world's best soccer players started life poor (see, e.g., Kuper and Szymanski, 2014; and section 4.2 below). Boys from poor households are less likely to go to college (Perna, 2006; Fack and Grenet, 2015). Living in crowded homes, they tend to spend more time outdoors, playing. Being poor, they have less money to spend in other leisure activities (Kuper and Szymanski, 2014).

The main prediction stemming from this line of reasoning is that countries with a high per-capita consumption of meat should produce more soccer talent on average, even after controlling for things like country wealth, size, and interest in soccer. We do not observe meat consumption by SES, but we can look at the personal backgrounds of the most talented players to assess their families' SES when growing up, and assign them the per-capita meat consumption of their country of origin at the time of their childhood. If our argument is correct, we predict that most players will come from low-SES households in high per-capita-consumption countries. The next two sections describe our data and present evidence consistent with these predictions.

3. Data

Our outcome of interest is *Soccer Prowess*, which counts the number of players, born in a given country, nominated to the *Ballon d'Or* in the period 2016 to 2019.[1] 59 players (from 25 different countries) were nominated to the *Ballon d'Or* in this period. The countries that contribute more players are France (11 players), Brazil, Netherlands, Spain, Portugal (4 players each), Argentina, Belgium, England, Germany, and Uruguay (3 players each).

We obtained data on meat and protein consumption by country from the Food and Agriculture Organization (FAO) of the United Nations.[2] *Meat Consumption* is the per capita consumption of meat, in kilograms, in 2000. *Protein consumption* is the per capita consumption of proteins (in grams, per day) in 2000. We choose the year 2000 to measure meat consumption because it is within our 2016-19 *Ballon d'Or* nominees' early childhoods. As discussed in the previous sections, the preschool years (i.e. 0–5 years of age) is a time of rapid and dramatic brain development, and of fundamental acquisition of cognitive development (i.e., working memory, attention and inhibitory control) – see, e.g., Victora et al. (2008), Rosales et al. (2009), and Jackson (2015).

Following Kuper and Szymanski (2014), we control for population and wealth in our regressions. A larger population means a larger supply of talented people in the country, and richer countries are better at finding, training, and developing talent. The data on countries' population and income comes from the World Bank.[3] *Population* is the total population of the country in 2000, in millions. It counts all residents regardless of legal status or citizenship. *GNI per capita*, our measure of wealth, is the gross

[1] The *Ballon d'Or* is the most prestigious soccer award, presented annually (since 1956) by France Football (https://www.francefootball.fr/ballon-d-or/).
[2] https://www.fao.org/faostat/en/#data/.
[3] https://data.worldbank.org/indicator/.

national income in 2000, converted to thousands of U.S. dollars using the World Bank Atlas method, divided by the midyear population.

To proxy for a country's interest in soccer (see, e.g., The Economist, 2018), we rely on the 2006 FIFA Big Count, a survey conducted by FIFA (Fédération Internationale de Football Association, the world governing body of soccer) in 2006 to its 207 member associations. The 2006 FIFA Big Count reports the number of people actively involved in soccer, by country. We divide these figures by the country's population (in millions) to construct the variable *Interest in Soccer*.

Table 1 presents summary statistics of the main variables used in our analysis.

[Table 1 about here]

4. Making a Maradona: meat and soccer

4.1. Econometric methods and results

We begin by examining the effect of meat consumption on soccer prowess in a regression framework. Formally, we want to estimate the following equation:

$$Soccer\ Prowess_i = \alpha + \beta * Meat\ Consumption_i + \gamma * X_i + \varepsilon_i \quad (1)$$

where *Soccer Prowess* is the number of players born in country i that were nominated to the *Ballon d'Or* in the period 2016 to 2019, *Meat consumption* is the per capita consumption of meat in country i in 2000, and ε is an error term. The vector of control variables, X, includes *Population* and, depending on the specification, *GNI per Capita*, *Interest in Soccer*, and a set of continent fixed effects. The coefficient of interest is β, which we expect to be positive.

Table 2 reports Ordinary Least Squares (OLS) estimates of equation (1). The estimated coefficient of *Meat Consumption* in column (1) is positive and statistically significant at the 1 percent level, indicating that countries with a higher per capita consumption of meat are more likely to breed soccer talent. The magnitude of the estimated coefficient is important: a one-standard-deviation increase in the consumption of meat is associated with an increase of 1/3 of a standard deviation in *Soccer Prowess*.

As shown in columns (2) to (4) of Table 2, the result is robust to progressively controlling for *GNI per Capita*, *Interest in Soccer*, and continent dummies. The estimated coefficient on *Meat Consumption* is smaller when we include the full set of control variables, but remains positive and statistically significant. In all cases, the control variables are statistically non-significant in explaining *Soccer Prowess*.

[Table 2 about here]

Table 3 shows our findings are robust to using *Protein Consumption* instead of *Meat Consumption* as the main explanatory variable in equation (1). In all cases, the coefficient on *Protein Consumption* is positive and statistically significant. Again, all control variables are statistically non-significant in explaining *Soccer Prowess*.

[Table 3 about here]

4.2. Socioeconomic status, meat, and talent

Having stablished a positive association between the consumption of meat and soccer prowess, we now move to explore the role of the opportunity cost of time. To do so, we study the early lives of each of the 59 players nominated to the *Ballon d’Or* in the period 2016 to 2019, and classify them according to their SES during childhood. We use three socioeconomic categories: high (including middle-high) class, middle class, and low (including middle-low) class. Among the 59 players, 33 were raised in a low- or middle-low-income family, 16 in a middle-income family, and 10 in a high- or middle-high-income family.[4]

We also divide countries according to terciles of per-capita meat consumption. We call the first tercile "countries of high meat consumption", the second tercile "countries of middle meat consumption", and the third tercile "countries of low meat consumption".

For example, Lionel Messi (Argentina) and Cristiano Ronaldo (Portugal) were raised in middle-low-income families in countries with high meat consumption; Neymar Júnior (Brazil), Luis Suarez (Uruguay), and Kylian Mbappé (France) in low-income families from countries with high meat consumption; Gianluigi Buffon (Italy) and Kevin De Bruyne (Belgium) in high-income families from countries with high meat consumption; and Sadio Mané (Senegal) and Edin Džeko (Bosnia and Herzegovina) in low-income families from countries with low meat consumption.

In Table 4, we report a classification of players according to childhood SES and meat consumption in their country of birth. As predicted, 28 of the 59 players nominated to the *Ballon d'Or* in the period 2016 to 2019 were raised in a low or middle-low income family, in countries with a high consumption of meat – a 47.46 percent, where pure chance would imply a figure of just 11.11 percent.

[Table 4 about here]

5. Concluding remarks

This paper provides novel evidence that poor individuals born in countries with high consumption of meat are more likely to have soccer prowess. More meat

[4] To obtain the information we conducted extensive Google searches in pages such as https://lifebogger.com/. Two research assistants independently classified all players, with 100% coincidence in their choices.

consumption implies a higher quality diet, which allows for the development of the cognitive functions required to excel in soccer. Poverty implies a low opportunity cost of putting those improved cognitive functions to use in soccer.

Meat consumption may explain part of the unexplained variability in soccer potential among national teams. The Economist (2018) builds a model that attempts to predict soccer goal differences through a country’s wealth, size, interest in soccer, and home advantage. As it turns out, the top overachievers (countries performing above the predictions of the model) are countries of high per capita consumption in our database (Uruguay, Brazil, Argentina, Portugal, and Spain).

How to improve a country’s performance in soccer is of paramount importance to many countries. Chinese president Xi Jingpin, for instance, is committed to transforming his country into a soccer superpower by 2050 (The Economist, 2018). To that end, 50,000 schools will be teaching soccer by 2025 in China and 20,000 new training centers are being built. The funds committed to the program are impressive. The largest training center alone, located in Guangzhou, will cost $185 million. Yet, China does not have much to show for all this spending, failing to qualify for the 2018 and 2022 World Cups (The Economist, 2018). Our results suggest that perhaps some of that money would be better spent in improving the nutrition of Chinese toddlers to support Mr. Xi’s goals. More generally, the children most behind on executive functions would benefit the most from any intervention that improves these functions (Diamond, 2013).

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Table 1. Summary statistics

	N	Mean	Standard Deviation	Minimum	Maximum
Soccer Prowess	221	0.335	1.166	0.000	11.000
Meat Consumption	170	43.732	31.366	3.525	125.131
Protein Consumption	171	74.516	20.706	36.460	123.650
Population	217	34.948	129.650	0.044	1262.645
GNI per Capita	184	6.921	10.253	0.130	45.650
Interest in Soccer	198	0.059	0.036	0.006	0.266

Notes: *Soccer Prowess* is the number of players nominated to the *Ballon d'Or* in the period 2016 to 2019. *Meat Consumption* is the per capita consumption of meat, in kilograms, in 2000. *Protein consumption* is the per capita consumption of proteins (in grams, per day) in 2000. *Population* is in millions. *GNI per capita* is in thousands of US dollars. *Interest in Soccer* is the ratio between the number of people in the country that are actively involved in soccer and the country's population (in millions).

Table 2. Meat consumption and soccer prowess

	Dependent variable: *Soccer Prowess*			
	(1)	(2)	(3)	(4)
Meat Consumption	0.0126***	0.0104**	0.0099**	0.0097**
	(0.0042)	(0.0044)	(0.0046)	(0.0047)
Population	0.0004	0.0003	0.0004	0.0006
	(0.0005)	(0.0004)	(0.0004)	(0.0005)
GNI per Capita		0.0134	0.0124	0.0055
		(0.0144)	(0.0144)	(0.0130)
Interest in Soccer			1.9593	0.6179
			(2.0420)	(2.4209)
R-Squared	0.115	0.130	0.133	0.181
Continent fixed effects	No	No	No	Yes
Observations	170	161	160	160

Notes: Robust standard errors are in parentheses. All regressions are estimated using Ordinary Least Squares and include a constant. **Significant at the 5% level. ***Significant at the 1% level.

Table 3. Robustness check: protein consumption and soccer prowess

	Dependent variable: *Soccer Prowess*			
	(1)	(2)	(3)	(4)
Protein Consumption	0.0195***	0.0164**	0.0162**	0.0114*
	(0.0070)	(0.0070)	(0.0070)	(0.0068)
Population	0.0002	0.0002	0.0003	0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GNI per Capita		0.0129	0.0101	0.0107
		(0.0125)	(0.0124)	(0.0123)
Interest in Soccer			2.8705	0.4283
			(2.0021)	(2.5541)
R-Squared	0.121	0.133	0.140	0.174
Continent fixed effects	No	No	No	Yes
Observations	170	161	160	160

Notes: Robust standard errors are in parentheses. All regressions are estimated using Ordinary Least Squares and include a constant. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 4. Players' socioeconomic status and meat consumption

		Consumption of meat			
		High	**Middle**	**Low**	
Socioeconomic status	**High & Middle High**	15,25%	1,69%	0,00%	16,95%
	Middle	22,03%	5,08%	0,00%	27,12%
	Middle low & Low	47,46%	5,08%	3,39%	55,93%
		84,75%	11,86%	3,39%	100,00%

Note: Figures in each cell correspond to the percentage of players nominated to the *Ballon d'Or* in the specific combination of SES and meat consumption.