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Colombian Migration and the Body Mass Index: The Relationship between Migration and Weight Gain among Colombian Migrants

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Abstract

The Latin American Migration Project-Colombia is used to study the Body Mass Index (BMI) of Colombian migrants to determine whether their BMI score increased the longer they were abroad. The study contributes to the literature on BMI by studying Colombian migrants, an understudied migrant group. Duration of trip is used as a measure of acculturation. The study also evaluates the claim that trip duration is a measure of acculturation using data specific to migrants, which shows that trip duration is an adequate proxy measure of acculturation. The study includes current migrants, returned migrants and non-migrants. The study accounts for the selectivity of migration by comparing migrants to non-migrants, as some studies highlight the health selectivity of migration. The study uses multinomial regression to test whether the probability of being overweight and/or obese is associated with spending more time abroad. Consistent with studies conducted within the receiving countries, the study finds that increased duration of trip is positively and significantly associated with the probability of being overweight and obese. Furthermore, the study also shows that among return migrants there is a negative relationship between time they had remained in Colombia and probability of being obese. The findings show that migrants put on weight while abroad and lose that weight the longer they remain in Colombia. The findings show that place has an indelible impact on health through migrant's weight.

Keywords

Body Mass Index, Migration, Colombia, Acculturation

1. Introduction

International migration is typically viewed as a process by which people move

between two countries. The migration could be motivated by many factors including social, political, and economic [1] [2]. The migration process may enable migrants to reunite with family, escape political repression, acquire capital to support family, build a house, or pay for medical procedures. Although migration leads migrants to resources, it also impacts their health as they adapt to the dominant culture in the receiving country which may include learning a new language, adopting new cultural traditions and culinary practices [3] [4]. The adoption of new cultural traditions includes dietary considerations, as migration means adapting to the diet of the receiving communities. For example, the longer migrants have been in the United States, the greater the change in their diet, which was measured by increased consumption of junk food, meat, vegetables, and fruit [3]. Similarly, dietary changes were also reported with regards to consumption of fruits and vegetables [4]. These dietary changes cannot be classified as uniformly good or bad, but it would be expected that migrants' BMI would increase with increased consumption of junk food. Culinary assimilation to the diet of the dominant population might lead to increased BMI. This study uses the LAMP-Colombia dataset to test whether international migration of Colombians is associated with increased BMI, as measured by duration of last trip abroad. The study predicts the BMI of current migrants, former migrants, and non-migrants.

2. Literature Review

There is a plethora of studies documenting that migration is associated with worsened health and an important measure of health is the Body Mass Index (BMI) as measured by the CDC [5]. Around 82% of the migrants in the LAMP-Colombia dataset report Spain and the USA as their destination. The World Health Organization reported that in 2016 the percent obese in the United States was 36.5% for males and 38.2% for females, which is more than in Spain where 27.1% of males and 27.2% of females were obese [6]. In Colombia, the percent obese is 17.3% for males and 26.7% for females. Given these different rates of obesity in Colombia, the United States, and Spain, one would expect that Colombian migrants would experience increased BMI after migrating to these countries. Independent of where Colombians migrate, one would expect that migration might be associated with worsened health given the stress associated with migration. It was reported that both internal Mexican migrants and US Mexican migrants experience greater levels of anxiety than non-migrants [7]. Therefore, it is necessary to control for such stress.

The literature about immigrant health has described an immigrant health paradox, a Hispanic health paradox, or a health advantage [7] [8] [9] [10]. The paradox lies in the fact that immigrants are generally poorer and have limited access to health care in the countries of origin, as people generally migrate to countries providing higher wages. Some studies have shown certain health benefits that immigrants exhibit when compared to US born. The advantage is often

reported using data collected in the US, which is problematic given the selectivity of migration based on health factors that have been reported [8] [10]. Therefore, it is important to address selectivity.

Weight gain could be beneficial for migrants who are underweight, but might cause other health problems for those who are overweight or obese. I establish several models predicting BMI among Colombians surveyed within Colombia, using the Latin American Migration Project data for Colombians. Previous studies mostly focused on migrants within the US [3] [4] [11] [12]. Such studies either look at some measure of assimilation or acculturation such as time in the US [4] [12] or other measures of assimilation such as English language ability [11] in predicting weight/BMI. Studies focusing on the relationship between duration of trip and BMI mostly show that the longer the duration, the greater the weight gain and increased likelihood of being overweight or obese [4] [13]. Therefore, it is expected that the longer the duration of the trip, the greater the increase in their BMI.

One study using the National Health Interview Survey from 1998 shows that there is a strong relationship between length of residence in the United States and BMI [14]. The authors report nearly a four-fold increase in BMI associated with time in the US. The study contributed to the study of BMI by using a national survey to look at Hispanics and the study included 2420 respondents. However, such pan-ethnic groupings miss important ethnic variation, as Hispanics could include very distinct groups such as Mexicans, Colombians, and Cubans, ethnic groups with very different migration experiences. For example, Mexicans have come as undocumented migrants with little education and Cubans have been welcomed as political refugees with much education from professional class backgrounds [15].

One study used the National Health Surveys from 1990-2004 to study obesity [16]. The survey focused on White, Black, Hispanic, and Asian immigrants. The study reported that the relationship between time in the US and obesity, based on BMI, is contingent upon education. Those with a BA degree did not experience increased obesity with a longer duration in the US, but those without a BA did experience increased obesity with duration. The study's strength is that it examined obesity nationally and focused on the three major racial groups and Hispanics. Using data with broad overarching pan-ethnic categories like Asian and Hispanic means that the study has limited capacity to talk about any of the ethnic groups, which makeup these pan-ethnic/pan-racial groupings. Despite the pan-ethnic grouping used in the study, the findings point toward the significance of education when considering the relationship between time in the US and BMI, a variable that the current study controls for in the statistical models presented later.

Some studies find that the relationship between time in the US and BMI is tied to gender. Ro and Bostean (2015) do not find a relationship between time in the US and BMI for Asian and Latino immigrant men, but do find a relationship for women, which suggests that it is important to control for gender differences

when predicting BMI [12]. Himmelgreen *et al.* (2004) only focused on Puerto Rican women in Hartford Connecticut and find that length of time in the US and language use are positively related with obesity among Puerto Rican women which the authors say shows that acculturation leads to weight gain [17]. The study improves on previous studies to include measures of language use and focuses on Puerto Ricans rather that pan-ethnic grouping such as Hispanics or Latinos. Given the findings, the present research controls for gender of respondent.

It is important to consider health of migrants before migration when predicting health in the receiving country. Since many studies focus on immigrants/migrants in the United States, they miss the fact that migrants are healthier than non-migrants, as migration is selective on health status [8]. Bostean (2013) used several surveys, one collected in the US and one in Mexico to test whether there was a selection process going on, which was labeled the healthy migrant hypothesis [8]. Bostean points out that most studies looking at immigrant health selectivity use data from the destination, but that does not permit comparisons with those who remained in their country of origin [8]. Bostean tests two hypotheses, one that tests whether less healthy migrants return to their country of origin and another that tests whether healthier migrants are selected for migration [8]. The study found that US born Mexicans fared worse in all health outcomes than first generation Mexican immigrants and recent immigrants had lower odds of poor health than settled immigrants. Although there were some findings that contradicted these hypotheses, the study supported both the healthy immigrant hypothesis and a salmon-bias effect for activity limitations. The study provides evidence of the selectivity of migration, which supports the need to compare migrants to non-migrants, which can only be accomplished by using data collected in the sending country.

Selectivity can be addressed by comparing migrants with non-migrants. Bostean (2013) provides evidence that immigrants are healthier than non-migrants which highlights the selectivity of migration [8]. Goldman *et al.* (2014) was able to compare migrants to non-migrants in a study about Mexican migration and health [18]. The study showed that current migrants were more likely to experience changes in their health status than earlier migrants and non-migrants. The study is not about BMI, but about one's self reported health, for which BMI is one component. For this study, the significance is that the study does compare migrants to non-migrants when estimating the impact of migration on health outcomes. For the current study, migrants' BMI will be compared to non-migrants to insure that selectivity is not a problem and other models compare just migrants to test for the salmon bias.

The immigrant health paradox suggests that immigrants would have better health than US born, but that advantage would decrease the more time they stayed in the US. However, Baker, Rendall, and Weden (2015) focused on childhood obesity and found that greater acculturation actually led to decreased probability of obesity, as children of immigrants were more likely to be obese than similar children of US born mothers [19]. The study provides evidence that child-

ren of immigrants actually have increased probability of obesity, so being a child of an immigrant is associated with worse health outcomes. As with many studies, the study only focuses on children in the US and cannot fully address how the migration process impacts obesity, but the study reports that acculturation is negatively associated with obesity.

The current study will compare migrants to those who remained in Colombia in terms of BMI, which provides an accurate comparison group given the selectivity of migration. Once selectivity is addressed, a 2nd model will be estimated which focuses on migrants to see whether place of interview impacts the finding which will serve as a test of the salmon bias.

The study also incorporates surveys conducted abroad to also account for the salmon effect. This comparison will speak to the impact of migration on body weight. Through time migrants would be expected to become more similar to those in the receiving country, which would mean that their diets would change to include more fat and sodium. The new diet would be expected to be associated with greater weight gain than someone who remained in Colombia.

3. Methods and Data

The current study uses the Latin American Migration Project data for Colombia [20]. The survey collected data about Colombian migration by conducting household surveys in Colombia between 2008 and 2016. In Colombia, 14 communities were surveyed representing 6 cities. The community surveys conducted household surveys randomly selecting 200 households within each community. The weighted data is representative of the combined communities surveyed, but is not representative of all Colombian migrants or Colombia. Additionally, the study includes respondents interviewed abroad, as not all migrants return to Colombia. Since the survey asked questions about health including height and weight, it is useful to study BMI. A total of 5001 respondents were asked about their weight and there were 228 missing cases for the weight question and 111 missing cases for the height question. The models include 4591 respondents, so there was a total of 410 missing cases between the dependent and independent variables.

The data come from the PERS file combined with the HOUSE file of LAMP-Colombia. Although the LAMP-Colombia provides information about all household members, this study only includes household heads and their spouses. Since height and weight are only available in the PERS file for household heads and their spouses, other household members cannot be included in this study. This study includes spouses, as it is important to include the spouses to reduce the over representation of men in the analyses given that men are more likely to be household heads. Previous research on migration has been critiqued as focusing on male migration, but women also migrate and studies must represent the migration experience of women [21].

The LAMP-Colombia data is related to the Mexican Migration Project (MMP), which was designed to collect information about the migration process by inter-

viewing return migrants about their migration experiences. The survey also collected some surveys in the United States and Spain, as current migrants may differ much from those who returned to Colombia. The LAMP-Colombia is a good dataset to address the impact of migration on BMI, as it allows researchers to compare migrants to those who never left Colombia. Given the selectivity of migration, it is important to compare migrants to those who never left Colombia. In the analyses presented in this study, 559 respondents had migrated which is about 12.18% of those included in the analyses.

Most of the people represented by the data are non-migrants, but a small portion of the population has made a trip outside of Colombia (12.18% of those included in the analyses included in this research) and for those people information is provided about how long their trip lasted. There is extensive information about the migration experience, but this project only includes variables that are available for both migrants and non-migrants, as non-migrants without migration experience have spent no time abroad. Therefore, it is not possible to include measures of linguistic assimilation given that this is unknown for non-migrants.

In light of the fascinating debate about how the migration process selects healthier people, this study did test whether there was selection occurring, which is necessary given the analysis on selectivity [8] [10]. The analyses that will be presented in the findings section accounts for selectivity, by comparing migrants to non-migrants and controlling for respondents interviewed abroad. Additionally, some tests of selectivity were performed that will be detailed. The unweighted BMI of non-migrants interviewed in Colombia is 25.03, the unweighted BMI of migrants interviewed in Colombia is 25.44 and the unweighted BMI of migrants interviewed abroad is 25.44. Weighted BMI for non-migrants is 24.90 and 24.94 for migrants, but weights are unavailable for migrants interviewed abroad. The differences are not statistically significant, suggesting that there is little measurable selectivity with regards to BMI found in this data. Additionally, some controls for where interviews were conducted were included in the models, but none of these tests were statistically significant. Although previous research reports the selectivity of health outcomes with migration, this selectivity is not detected in this LAMP-Colombia data for BMI.

BMI

According to the CDC webpage, BMI is calculated by dividing weight in kilograms by one's height in meters squared [22]. The CDC also indicates what the BMI scores mean, where 0 - 18.5 is underweight, 18.5 - 24.9 is normal or healthy weight, 25 - 29.9 is overweight, and 30+ is obese. Although the BMI could be considered a continuous variable, I use these BMI scores to create 4 categories representing underweight, normal or healthy weight, overweight, and obese. Given that low scores represent being underweight and high scores indicate being overweight or obese, a categorical grouping of these scores is more representative of the meaning of the index.

There are many health outcomes that this study could address, BMI was selected for several reasons. The LAMP-Colombia includes a variety of health outcomes, but the BMI data collected is clearly post-migration. Some of the health variables refer to some point in the past, but are not clearly post-migration. Additionally, BMI is a health outcome that may lead to other negative health outcomes such as high blood pressure, heart disease, coronary heart disease, stroke, Type 2 diabetes, gallbladder disease, osteoarthritis, mental illness, body pain and other diseases [23] [24].

I used multinomial logistic regression to predict whether Colombians are underweight, overweight, or obese as compared to those deemed by the BMI to be normal or healthy weight. This choice might seem inconsistent with the nature of the BMI index. However, an ordinal logit regression was originally fitted, but the BMI index does not appear to meet the criteria for ordinal variables, as being underweight or obese are both bad outcomes and are at opposite ends of the distribution. Both negative outcomes are best compared to those who are normal or healthy weight. Given the meaning of the BMI categories, using a multinomial regression allows for the comparison of categories such as underweight, overweight, and obese to those classified as normal weight without suggesting that being underweight, overweight, or obese are better outcomes.

Most of the studies focusing on immigrants focus on time spent in the US as a measure of acculturation. This study includes a measure that represents duration of last trip abroad (in months). This is the main measure of acculturation.

The study includes many controls to represent wealth, demographics, health, and community. In terms of wealth, controls are included in the analyses to represent homeownership and business ownership. Demographic characteristics include whether they are female, years of education, marital status, and # of children. The study controls for several health measures, which may be associated with weight gain. These measures of health include whether the respondent smokes and whether they have diabetes or high sugar levels, hypertension or high blood pressure, or an emotional, nervous, or psychiatric problem.

Since the surveys were conducted in many different communities with different characteristics, it is important to control for community effects. There were five communities that were controlled, including Risalda, Quindío, Cundinamarca, Valle, and Atlántico. Additionally, since some interviews were conducted in Spain (616) and the United States (94), I also account for respondents for which we do not know which was their community, but only 102 of these respondents end up in the analyses. Including a control for respondents surveyed abroad is also necessary given the literature suggesting that there is positive health selection with migration and negative health selection with return migration [8] [10]. Those interviewed abroad are current migrants and the rest are former migrants who have already returned to Colombia.

4. Findings

Table 1 includes the weighted dependent variable which is the Body Mass Index

Table 1. Weighted descriptive statistics for Colombians, Migrants, and Non-Migrants.

	Colombian		Migrants		Non-Migrants	
	Mean	SD	Mean	SD	Mean	SD
BMI						
Underweight	0.02	0.14	0.01	0.08	0.02	0.15
Normal	0.56	0.50	0.58	0.49	0.55	0.50
Overweight	0.33	0.47	0.33	0.47	0.33	0.47
Obese	0.09	0.29	0.08	0.27	0.09	0.29
Destination						
Spain	-	-	0.49	0.50	-	-
United States	-	-	0.33	0.47	-	-
Migration						
Duration of Last Trip Abroad (months)	21.01	67.70	-	-	-	-
Time Since Migration (years)			15.57	10.27	-	-
Wealth						
Owns Home	0.53	0.50	-	-	-	-
Owns Business	0.25	0.43	-	-	-	-
Demographic						
Female	0.28	0.45	-	-	-	-
Education	9.05	4.68	-	-	-	-
Married	0.80	0.40	-	-	-	-
Children	2.58	1.95	-	-	-	-
Health						
Smokes	0.11	0.31	-	-	-	-
Sugar	0.09	0.28	-	-	-	-
Hypertension	0.25	0.43	-	-	-	-
Nervous Disorder	0.06	0.23	-	-	-	-
Community						
Risaralda	0.32	0.47	-	-	-	-
Quindío	0.08	0.27	-	-	-	-
Cundinamarca	0.16	0.36	-	-	-	-
Caldas	0.07	0.25	-	-	-	-
Valle	0.30	0.46	-	-	-	-
Atlántico	0.09	0.28	-	-	-	-
Interviewed Abroad						
USA/Spain Interview*	0.02	0.15	-	-	-	-
N	4591		559		4032	

*Unweighted means since those interviewed abroad were not assigned a weight.

(BMI) and the descriptive statistics about the independent variables included in the analyses in this research project for all Colombians surveyed, for migrants, and for non-migrants. The BMI index shows that there are relatively few underweight Colombians (2%), but more overweight (33%) and obese (9%) Colombians. The weighted sampling statistics are included for migrants and non-migrants. The weighted statistics show that there are about the same amount of obese migrants (8%) as non-migrants (9%) and about the same percent of overweight (33%) migrants and non-migrants. Migrants went primarily to two destinations, Spain (49%) and the United States (33%). Migrating to these destinations is significant, given that the rate of obesity in 2020 in the United States (36.20%) and Spain (23.80%) is higher than Colombia (22.30%) according to the World Health Organization [6]. These descriptive statistics do not suggest much selectivity in terms of BMI given that the BMI of migrants and non-migrants are quite similar.

In terms of wealth, two measures are controlled, homeownership and business ownership. About half the respondents own a home (53%) and about 25% own a business. Clearly the population has access to resources through these assets.

The models include controls for typical demographic characteristics including gender, education, marital status, and # of children. About 28% are female. Respondents had an average of 9 years of education, 80% were married, and they had an average of 2.6 children.

The analyses also accounts for the health of the respondents. About 11% smokes, 9% has diabetes, 25% has hypertension, and 6% has some kind of nervous disorder. The population statistics suggest that it is a fairly healthy population that has some health problems.

Respondents came from six different communities including Risaralda, Quindío, Cundinamarca, Caldas, Valle, and Atlántico. Risaralda accounts for 32%, Quindío 8%, Cundinamarca 16%, Caldas 7%, Valle 30%, Atlántico 9%, and 2% were interviewed in the USA or Spain.

The literature has used length of time in the US as a measure of assimilation. It is intuitive that the longer a migrant remains in a country, the more assimilated they would become. However, it is important to validate this presumed relationship. Using data from the MIGS file from the LAMP-Colombia dataset, it is possible to evaluate this relationship among household heads who were migrants.

Table 2 looks at two measures of assimilation to illustrate the relationship between duration of trip and assimilation among the migrant population represented in the MIGS file of LAMPS-Colombia who were asked questions about their assimilation, but these measures are only available for migrant household heads in the MIGS file. Many studies assume that duration of trip is a measure of assimilation, so it seems important to establish whether this is the case. Here two measures of assimilation are used, language proficiency and relations with natives. In terms of language proficiency, those indicating that they did not speak or understand much of the language of the receiving country had an average

Table 2. Duration of last trip and measures of assimilation of migrants.

Language Proficiency	
Neither Speaks or Understands	69.43
Does not Speak, but understands some	63.05
Does not Speak, but understands much	98.27
Speaks and understands some	117.56
Speaks and understands much	123.05
Relations with Natives	
None	106
Workplace Only	110.1
Friendship	129.2
Very Close	131
N	420

trip of 69 months, which is similar to the 63 months that was reported by people who did not speak the language, but understood some. As Trip Duration abroad increased, so did language proficiency, such that those who indicated that they spoke and understood the language of the dominant population had an average trip duration abroad of 123 months which is nearly twice that of migrants who did not speak or understand. In terms of relations with natives, greater relations with natives was positively related with trip duration abroad. Those who did not have relations with natives had an average trip duration of 106 months, those with workplace only relations had a trip duration lasting 110 months, those with friendships with natives trip duration was 129 months and those who had very close relations with natives had an average trip duration of 131 months. Although Table 2 only examines descriptive statistics for trip duration abroad, these averages for trip duration abroad reported for language proficiency and relations with natives seem to support the argument that trip duration abroad is a good proxy measure of assimilation.

Multinomial Regression

A multinomial regression is used to predict the BMI categories of underweight, overweight, and obese and these three categories are compared to normal/healthy weight. The model includes both migrants and non-migrants, and includes many controls that are included in other studies on BMI.

Table 3 provides the multinomial regression predicting the BMI index. The first set of explanatory variables employed pertain to length of trip. Length of Trip is unrelated with being underweight. However, length of trip is positively and significantly (at the 0.01 level) related with being overweight (0.002 per month) and is also positively and significantly (at the 0.05 level) related with being obese (0.003 per month).

Table 3. Multinomial regression predicting categories of body mass index of migrants.

	Underweight		P	Overweight		P	Obese		P
	Coef.	SE		Coef.	SE		Coef.	SE	
Migration									
Duration of Last Trip Abroad (months)	0.000	0.003		0.002	0.001	**	0.003	0.001	*
Wealth									
Owns Home	−0.263	0.224		−0.078	0.068		−0.210	0.109	
Owns Business	−0.184	0.266		0.255	0.073	**	0.408	0.113	**
Demographic									
Female	0.241	0.284		0.040	0.089		0.252	0.134	
Education	−0.044	0.027		−0.008	0.008		−0.016	0.013	
Married	−0.114	0.308		0.220	0.102	*	0.283	0.155	
Children	−0.052	0.062		0.024	0.018		0.041	0.027	
Health									
Smokes	0.671	0.272	*	0.063	0.106		−0.005	0.173	
Sugar	0.255	0.378		0.135	0.118		0.334	0.161	*
Hypertension	−0.184	0.287		0.334	0.082	**	0.892	0.119	**
Nervous Disorder	0.882	0.321	*	−0.319	0.147	*	0.065	0.195	
Community									
Quindío	−0.036	0.432		0.016	0.146		−0.088	0.233	
Cundinamarca	−0.289	0.467		−0.224	0.137		−0.342	0.239	
Caldas	0.243	0.395		0.154	0.141		−0.328	0.264	
Valle	−0.136	0.277		0.163	0.085		−0.406	0.138	
Atlántico	0.040	0.392		01	0.111	**	0.780	0.161	**
USA/Spain Interview	−0.687	1.100		0.117	0.246		0.131	0.384	
Constant	2.736	0.480	*	−0.856	0.154	**	2.374	0.242	**
N	4.639								
Log-Likelihood Chi^2	246.6								

* = P ≤ 0.05, ** = P ≤ 0.01.

The models also control for a few measures of wealth based on home ownership and business ownership. Owning a business is positively related with being overweight (0.255) and obese (0.408), both of these relationships are statistically significant at the 0.01 level.

The model accounts for several measures of demographic characteristics such as gender, education, marital status and # of children. Marital status is positively related with being overweight (0.220) at the 0.05 level, but none of the other demographic measures are associated with any of the BMI categories.

Health outcomes are also related with the BMI categories. Smoking is positively related with being underweight (0.671) at the 0.05 level. Having hypertension is positively related with obesity (0.334). Having hypertension is positively related with being overweight (0.334) and obese (0.892) both relationships are significant at the 0.01 level. Having a nervous disorder is positively related with

Table 4. Multinomial regression predicting categories of body mass index of migrants.

	Overweight		P	Obese		P
	Coef.	SE		Coef.	SE	
Migration						
Experience Abroad (months)	0.002	0.001		0.006	0.003	*
Time Since Return (years)	−0.010	0.014		−0.055	0.028	*
USA	−0.122	0.323		0.320	0.509	
Spain	0.071	0.303		−0.114	0.494	
Wealth						
Owns Home	−0.052	0.215		−0.663	0.360	
Owns Business	0.198	0.222		0.004	0.372	
Demographic						
Female	−0.049	0.227		−0.114	0.370	
Education	−0.035	0.030		−0.025	0.048	
Married	0.368	0.237		0.776	0.410	
Children	0.118	0.078		0.270	0.114	
Health						
Smokes	−0.365	0.312		0.493	0.417	
Sugar	1.157	0.428	**	0.290	0.665	
Hypertension	0.304	0.293		1.092	0.398	**
Nervous Disorder	0.935	0.540		−0.152	1.118	
Community						
Quindío	−0.792	0.516		−0.692	0.850	
Cundinamarca	−0.200	0.362		0.039	0.560	
Caldas	0.088	0.587		−0.380	1.124	
Valle	0.060	0.266		−0.076	0.434	
Atlántico	0.403	0.389		0.640	0.573	
USA/Spain Interview	0.007	0.318		0.146	0.492	
Constant						
Constant	−0.547	0.545		−2.343	0.888	**
N	560					
Log-Likelihood Chi^2	66.260					

* = P ≤ 0.05, ** = P ≤ 0.01.

being underweight (0.882) and negatively related with being overweight (−0.319), both relationships are significant at the 0.05 level.

In terms of community effects, only Atlántico stands out. The models show that respondents from Atlántico are more likely to be overweight (0.513) or obese (0.780) and both of these relationships are significant at the 0.01 level. Overall, the coefficients for community are important to include given that there may have been variation between communities in terms of BMI, but few of these coefficients are statistically significant.

Table 4 is similar to Table 3, but only includes migrant household heads and their spouses, therefore it includes fewer respondents. The model includes 3 additional migration variables including time since return and destination of Spain and USA, as these variables are only available for migrants. The analysis could not include those who are underweight, as there were only 7 which is too few to model a multinomial regression. Here we just focus on the migration variables.

The analysis includes far fewer cases, so it is more difficult to fit and get significant relationships. However, the model shows that there is a positive relationship with length of trip and being obese with a coefficient of 0.006 which is significant at the 0.05 level. The variable time since return is also negatively related with being obese and the coefficient is −0.055, which is significant at the 0.05 level. The model shows that migrants gain weight the longer they are away from Colombia and they appear to lose this weight the longer they remain in Colombia upon return.

5. Conclusions

The study was carried out to test whether the migration process is associated with increased BMI, as previous studies have shown that BMI is positively related with time spent in a country. Many studies documenting this relationship are based on data collected in the receiving country, so they are unable to make comparisons with people who remained in the sending country. Given the selectivity of migration that is well documented, it is important to compare migrants to non-migrants to account for the selectivity of migration on health outcomes such as BMI. It is widely reported within the literature on BMI that immigrants experience weight gain the longer they remain in the US. The study makes a contribution to the literature by testing this relationship within the Colombian population, a population rarely/never studied within the BMI literature. This positive relationship is assumed to show that increased assimilation leads to weight gain due to the migrant's new diet in the receiving country, as assimilation is thought to lead to dietary assimilation. The study found support for this relationship with regards to obesity.

Assimilation to the dominant population is assumed to lead to better life chances. Migrants often move to their destinations in order to improve labor market outcomes, which are limited in Colombia. Assimilation theory predicts that assimilation would lead to better life chances, but this study documents that assimilation to the receiving community might lead to weight gain which results in

increased odds of being overweight or obese, which in turn has been found to lead to heart disease and worsened general health [24] [25]. Although migrants reap economic gains with their migration, their health may be negatively impacted by the weight gain associated with migration.

The study did evaluate the relationship of duration of last trip as a measure of assimilation. It appears that two measures of assimilation are positively associated with duration of last trip. Having friendships with members of the dominant population in the receiving countries and being proficient in the language of the receiving country is positively related with duration of last trip. It is reassuring to confirm that duration of last trip is a good measure of assimilation, as such measures are unavailable for the non-migrants included in the analyses reported in this research.

The current research establishes that there is a relationship between duration of last trip and BMI as it relates to obesity. This measure suggests that the migration process is associated with increased BMI, perhaps partially due to the dietary assimilation to the receiving country, which some studies report means more junk food [3].

The study examined the BMI among migrants which reveals the relationship between duration of trip and obesity. The model also includes a measure of time since return in years and this measure is negatively related with obesity among migrants. So the analyses among migrants shows that the weight gain they experience with migration decreases the longer they stay in Colombia. This finding demonstrates that health is inextricably related with place, so weight gain from migration decreases the longer migrants remain in Colombia.

The study addressed selectivity and the salmon bias. In terms of selectivity, the results do not appear influenced by selectivity given that the models in **Table 3** which includes both migrants and non-migrants are similar to those included in **Table 4** which includes only migrants. Additionally, the study compared the BMI of migrants and non-migrants in **Table 1** and the two groups are quite similar.

The study contributes to the literature by focusing on the BMI of an understudied group, Colombians. Previous findings reporting that assimilation is associated with worsened health using data that did not account for the selectivity of migration are consistent with the current study's findings which account for selectivity. It is important to establish the relationship between time abroad and BMI, as length of trip has been shown to be associated with some health outcomes and not others [8]. However, this research confirms that duration of trip is positively associated with BMI, as measured by being overweight and obese. Furthermore, when Colombian migrants return to Colombia, their weight decreases. The study demonstrates the impact of place on one measure of health, their weight.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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