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Modern health standards for peoples of the past: biological conditions by race in the American South, 1873 - 1919

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MODERN HEALTH STANDARDS FOR PEOPLES OF THE PAST: BIOLOGICAL CONDITIONS BY RACE IN THE AMERICAN SOUTH, 1873 - 1919

SCOTT ALAN CARSON

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Abstract

Recent modern life expectancy improvements rely heavily on medical intervention; however, before the mid-20th century, increased longevity was primarily the result of improved nutrition and less virulent disease environments. Moreover, 19th century health conditions varied by race, especially in the American South. The body mass index (BMI) reflects health conditions, and male BMIs in Texas State Prison reflected diseases associated with low BMI diseases, i.e., respiratory and infectious diseases, and tuberculosis. When able to work, Southern African-Americans in the 19th century acquired heavier BMIs during prime working ages; however, when they were no longer productive and exited the labor force, their BMIs declined, and older black males became more vulnerable to low BMI diseases.

JEL Code: I10, I32, J15, N11, N30, N37.

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Modern Health Standards for Peoples of the Past: Biological Conditions by Race in the American South, 1873-1919

1. Introduction

Modern African-Americans are more likely than whites to die from diabetes mellitus, stroke and heart disease (Valanis, 1999, p. 123), which are related to diet and exercise, two largely controllable health variables. Moreover, proper diet and physical activity can alter the human body in ways favorable to health. Two prominent physiological measurements are stature and the body mass index (BMI). A population's average stature reflects the cumulative balance between nutrition, and energy expended for work and to fend off disease, and black stature in the Reconstruction South appears to have recovered more rapidly than white stature from the political and economic displacement brought by slavery's removal. A population's average BMI reflects the current balance between nutrition and calories required for work and to fend off disease and is more sensitive than stature to the immediate effects of privation (Fogel, 1994, p. 375). BMIs have also been linked to modern health outcomes (Waalder, 1984; Stevens et al, p. 1998, 1-7; Calle et al, 1999, p. 1097-1104; Kenchaiah et al, 2002, p. 305-313; Calle et al, 2003, pp. 1625-1638; Pi-Sunyer, 1991, pp. 1595s-1600s; Jee et al, 2006; Costa, 1993). In the 19th century American South, African and European Americans faced considerable economic and social change during the antebellum and Reconstruction periods, and while slavery directly affected the material and biological welfare of

African-Americans, its removal also influenced the material and biological welfare of whites.

When brought to maturity under ideal biological environments, blacks and whites come to similar terminal average statures (Eveleth and Tanner, 1976; Tanner, 1977; Steckel, 1995, p. 1910; Barondess, Nelson and Schlaen, 1997, p. 968; Komlos and Baur, 2004, pp. 64, 69; Nelson et al., 1993, pp. 18-20; Godoy et al, 2005, pp. 472-473), and modern studies indicate the prevalence of obesity is comparable between blacks and whites (Barondess, Nelson and Schlaen, 1997, p. 968; CDC, 2004, 1066-1067; Nelson et al., 1993, pp. 18-20; Godoy et al, 2005, pp. 472-473). This suggests that racial differences in height and BMI may be, in part, attributable to the environment. While we have few direct weight measures for slaves in the American South, a relevant period is between 1870 and 1920, a period when freed blacks were acclimating to the opportunity and hardships of life beyond the slave system. During the Reconstruction period, black incomes probably increased, and blacks devoted a higher share of their incomes to the acquisition of food, which may have increased black body mass (Higgs, 1977, p. 107). Moreover, biological conditions varied with labor market participation, and if workers were not healthy or denied access to opportunity, their biological welfare suffered.

It is against this backdrop that three questions regarding historical Southern BMIs and health are considered. First, how did black and white BMIs change with age? Modern studies demonstrate that male BMIs increased with age until their 70s. However, modern populations are not subject to overt forms of racial prejudice experienced by 19th century blacks. Second, the 19th century American South experienced tremendous degrees of socioeconomic change. How did black and white BMIs vary by

socioeconomic status? Third, while emancipation released blacks from overt bondage, racial prejudice was the rule throughout 19th century America, and different regions within the US had varying diets and disease environments. How did black and white BMIs vary by region?

2. Data

BMI serves as a reasonable approximation for health, especially in historical populations where medical records are non-existent or not well preserved. Waaler (1984) uncovers a U-shaped relationship between mortality risk and BMI in a modern European sample, with the lowest mortality risk corresponding to a BMI of 25. When a population's average BMI is low, health conditions related to under nutrition, infectious diseases and respiratory conditions are prominent (Jee et al, 2006, 783; Calle, et al, 1999, p. 1101), and if a population's average BMI is higher, health conditions related to diabetes mellitus, cardiovascular disease, stroke and cancer are prominent (Calle et al, 1999, 1101). Costa (1993) and Murray (1997) demonstrate that the Waaler relationship is stable over time, and Jee et al (2006, pp. 780, 784-785; Adams et al, 2006, p. 765; Calle et al, 1999, p. 1101) demonstrate the relationship is robust across racial groups, which indicates that valid warrants and inferences can be drawn about past populations by using modern BMI patterns and trends.

Chronic diseases related to low BMIs include infectious diseases, tuberculosis and diarrhea. Chronic diseases related to high BMIs include respiratory difficulties and chronic musculoskeletal, fertility and skin problems (World Health Organization, 2005, p. 2). Life threatening conditions associated with high BMIs include cardiovascular disease, type 2 diabetes, gallbladder diseases and large bowel cancers (Pi-Yunyer, 1991),

and obesity elevates the risk of esophagus, colorectal, breast cancers, endometrium and kidney disease (Calle et al, 2003, p. 1628-1631). Consequently, historical populations should have suffered more from infectious diseases, tuberculosis, and chronic diseases relative to the modern incidence of cardiovascular disease, type 2 diabetes, gallbladder disease and large bowel cancers (Crimmins and Condran, 1983, p. 33).

Using post-Reconstruction records from The Citadel, Komlos and Coclanis (1995, pp. 100-103) find that white student BMIs decreased during the 1880s and 1890s but recovered during the earliest years of the 20th century. This indicates that white BMIs may have been adversely impacted by the removal of slavery. Black biological welfare was also influenced by diets provided under slavery and Reconstruction, which later became standard fare in free-black diets. Beyond rationally manipulating slave diets to maximize the net present value of their slave property, slave masters sought low-cost calorie food sources and consciously fed their slaves high quantities of fat-back pork, corn and molasses (Kiple and Kiple, 1981, pp. 80-82; Hilliard, 1972). After slavery's removal, blacks continued to consume high fat diets, which in turn influenced their BMIs, exposure to diabetes, stroke and heart disease.

Most medical records for blacks and whites in the late 19th century American South suggest that prominent mortalities were infectious and respiratory diseases, which are low BMI diseases (Kiple, 1981; Kiple and Kiple, 1977, pp. 419-421; Crimmens and Condran, 1983, p. 33, Table 1). However, beyond stature studies, data to corroborate the historical relationship between physical compositions in the South have been sparse. Prison records are particularly useful for examining changes in biological living conditions because their accurate recording had legal implications, and they are more

likely to be drawn from lower social classes, that segment of society most vulnerable to economic change (Bogin, 1991, p. 288).¹ While prison records are not random samples, the selectivity they represent has its own advantages, such as being drawn from low socioeconomic groups with consistent entry requirements over time. For BMI studies as an indicator of biological change, this kind of selection is preferable to the type of selection that afflicts military samples—minimum stature enlistment requirements.

Between 1873 and 1920, prison guards at the Texas state prison routinely recorded the dates inmates were received, age, complexion, nativity, height, weight, pre-incarceration occupation and crime. There is concern over how possible Texas law enforcement influenced BMIs. However, no evidence that legal or enforcement changes influenced inmate BMIs have been found, and height and weight measurements were taken at the time inmates were incarcerated, therefore, reflected pre-incarceration conditions (Walker, 1988, p. 125). Blacks were more common than whites in the Texas prison, but there is little evidence that blacks were targeted by Texas law enforcement officials. However, black disproportional over representation is likely due to no legal representation in court cases (ibid, 1988, pp. 114-115).

Fortunately, inmate enumerators were quite thorough when recording inmate complexion and occupation.² For example, enumerators recorded black inmates' race in

¹ Many 19th century and earlier stature measurements were rounded to the nearest inch or half inch.

However, there was great care in recording inmate statures because accurate measurement may have had legal implications in the event that an inmate escaped and later was recaptured. Most inmates' statures were recorded at a quarter, eighth, and even sixteenth increments.

² Although the Texas Prison data set allows access to a large and valuable set of inmates of Mexican nativity residing in Texas, the focus of this paper is the comparison between white and black inmates.

a complexion category as black, light black, dark black or various shades of mulatto.³

While mulatto inmates possessed genetic traits from both European and African ancestry, they were treated as blacks in the American South and are grouped here with black inmates.⁴ Enumerators recorded white inmate complexions as light, medium and dark. The white inmate complexion classification is further supported by the complexion of European immigrants, who were always of fair complexion and were also recorded as light, medium and dark.⁵

Enumerators recorded a broad continuum of occupations and defined them narrowly, recording over 200 different occupations. These occupations are classified here into four categories. Workers who were merchants and high skilled workers are classified as white-collar workers; manufacturing, craft workers and carpenters are classified as skilled workers; workers in the agricultural sector are classified as farmers; laborers are classified as unskilled workers.⁶ By having the same prison official record

³ Like Komlos and Coclanis (1997), inmates with complexions recorded as black, brown, copper, dark brown, dark mulatto, ginger, light brown, light mulatto, mulatto and yellow are considered as black. Inmates with complexions recorded as fair, florid, dark, light, ruddy, sallow, sandy and swarthy are considered as from European ancestry.

⁴ While some studies in 19th century African-American anthropometric history find a “mulatto advantage,” there is little evidence that fairer skinned African-Americans in the Texas prison had a distinct stature advantage over darker skinned African-Americans.

⁵ I am currently collecting 19th century Irish prison records. Irish prison enumerators also used light, medium, dark, fresh and sallow to describe white prisoners in prisons from a traditionally white population. To date, no inmate in an Irish prison has been recorded with a complexion consistent with African heritage.

⁶ Prison guards who recorded occupation did not distinguish between farm and common laborers. This potentially overestimates the biological benefits of being a common laborer and underestimates the

characteristics over much of the period, the consistency of the Texas prison sample creates reliable comparisons across race and time.

Table 1, Texas Prison Inmate Demographics and Occupations

Age	<i>Black</i>		<i>White</i>		Occupations	<i>Black</i>		<i>White</i>	
	Percent	N	Percent	N		Percent	N	Percent	N
Teens	19.00	5,123	15.68	2,513	White-Collar	2.43	654	11.13	1,784
20s	54.56	14,712	51.22	8,211	Skilled	2.64	712	12.25	1,963
30s	16.37	4,413	20.43	3,275	Farmer	14.39	3,879	16.21	2,598
40s	6.66	1,795	8.04	1,289	Unskilled	78.72	21,146	56.56	9,067
50s	2.40	647	3.57	572	No Occupation	2.12	572	3.86	618
60s	0.86	231	0.90	145					
70+	0.16	42	0.16	25	<i>Nativity</i>				
					Northeast	0.14	38	0.86	138
<i>Birth</i>					Middle	1.06	285	4.68	751
<i>Decade</i>					Atlantic				
1820s	0.55	148	0.45	72	Great Lakes	0.91	246	6.94	1,113
1830s	1.78	479	1.63	261	Plains	1.51	407	6.87	1,102
1840s	5.34	1,439	6.33	1,014	Southeast	23.57	6,355	32.18	5,158
1850s	15.73	4,242	18.21	2,919	Southwest	72.59	19,573	47.21	7,568
1860s	23.55	6,350	20.65	3,310	Far West	0.22	59	1.25	200
1870s	23.03	6,209	23.25	3,727					
1880s	18.51	4,992	18.31	2,935					
1890s	10.49	2,829	10.54	1,690					
1900s	1.02	275	.064	102					

Source: Source: Data used to study Texas anthropometrics is a subset of a much larger 19th century

prison sample. All available records from American state repositories have been acquired and entered into a master file. These records include Arizona, California, Colorado, Idaho, Illinois, Kansas, Kentucky, Missouri, New Mexico, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah and Washington. Prison records used in this manuscript are Arizona, Colorado, New Mexico, and Texas.

advantages from being a farm laborer, since common laborers typically came to maturity under less favorable biological living conditions. The occupation classification system used here replicates that used by Ferrie “Entry into U.S. Labor Markets,” p. 325; *Yankeys Now*, 1999. See the appendix for the occupation classification system used here.

Age percentages demonstrate that black inmates were incarcerated in their younger ages; white inmates were incarcerated at older ages (Table 1).⁷ Southern slave law evolved to favor plantation law, which generally allowed slave-owners to recover slave labor on plantations while the slave was punished (Wahl, 1996 and 1997; Friedman, 1993, pp. 84-106). As a result, birth decades indicate that white inmates born before the Civil War took up proportionally larger shares of the Texas prison population than black inmates. However, with passage of the 13th Amendment, slave-owners no longer had claims on black labor, and freed blacks who broke the law were turned over to the Texas penal system to exact their social debt.

Occupations reflect socio-economic status, and while prison inmates typically come from the lower socioeconomic groups, there was a sizable share of inmates from white-collar and skilled occupations. White inmates were 363 percent more likely than blacks to occupy white-collar occupations and 366 percent more likely than blacks to occupy skilled occupations. Even in agriculture, whites were more likely than blacks to come from planting and stock raising occupations. The difference, of course, was in the unskilled category. Incarcerated blacks were 39 percent more likely than whites to occupy unskilled occupations, making pre-occupations within the Texas prison

⁷ Higgs, *Competition and Coercion*, p. 1, indicates effective discrimination by public institutions during the 19th century, which suggests that young blacks may have been targeted by law enforcement. Higgs, *Competition and Coercion*, 10, also indicates that Blacks were more likely to be convicted and receive longer sentences or larger fines than comparable white offenders. Friedman, *Crime and Punishment*, pp. 90, 94, 96, and 156 indicates that 19th century blacks may have been targeted by prejudiced public institutions.

segregated; white-collar, skilled, and agricultural occupations were filled by whites and unskilled occupations were filled by blacks.

Table 2, Nineteenth Century Texas Occupations by Race

	1860	1870		1880		1900	
	White	Black	White	Black	White	Black	White
White-Collar	9.63	.80	11.37	1.69	8.74	2.30	11.36
Skilled	7.79	.80	21.73	2.15	7.27	1.30	9.46
Farmer	66.29	38.40	59.56	59.97	65.46	54.80	58.89
Unskilled	16.29	60.00	21.73	34.82	17.06	41.60	20.18
No Occupation	0	0	0	1.38	1.46	0	.11

Steven Ruggles, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King, and Chad Ronnander. *Integrated Public Use Microdata Series: Version 3.0* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2004.

To assess the representativeness of the prison sample, Texas prison occupation distributions can also be compared to occupation distributions in the Texas census (Table 2). Proportionally more prisoners were white collar, skilled and unskilled workers, and fewer farmers in the prison population than in the Texas census, indicating that while prisoners were drawn from lower classes, they were not necessarily unskilled. These striking occupational differences between blacks and whites were undoubtedly due, in part, to Southern institutional arrangements. Under slavery, blacks were trained in plantation skills, and did not choose the occupations they desired (Ransom and Sutch 1977, p. 17; David and Temin, 1976, p. 45-46). After slavery, blacks could not acquire the skills they desired because they were denied access to the education and training that would facilitate their upward occupational mobility into white-collar and skilled

occupations.⁸ Moreover, blacks faced rigid hiring processes after slavery was abolished and were unlikely to be hired into skilled positions.⁹ However—black and white—occupations reflected physical activity, which were related to BMIs and health.

Inmate nativity in the Texas prison was predominantly North American and was largely from the lower South, although some came from the upper South (Walker, 1988, p. 119). Northeastern and middle Atlantic inmates typically did not migrate to the South, commit crimes and were incarcerated in Texas. Nor did inmates in the Texas state prison come from the Great Lakes, Plains, Southwest and Far West regions, suggesting that the internal migration flow into the South among the criminal element was limited.¹⁰

⁸ Ransom and Sutch. *One Kind of Freedom*, pp. 28-30, 177-179; In the face of postbellum Reconstruction, blacks demonstrated remarkable resilience to acquire what had so long been denied them. Marable, “Politics of Black Land Tenure,” p. 140, suggests that by 1910 blacks had succeeded to a limited degree to attain economic advancement. Despite exclusion from general human capital accumulation acquired in more traditional educational institutions, blacks banded together to establish institutions where they could acquire market specific skills. Examples include the Agricultural and Mechanical College for Negroes, the Utica Institute and Booker T. Washington’s Tuskegee Institute, pp. 145-147. Southern blacks also attempted to form banks, 144-145. Unfortunately, these extraordinary examples of black progress during Reconstruction did little to influence black biological living conditions at the lower ordinal ranks of late 19th century southern society.

⁹ Maloney, “Degrees of Inequality” and “African Americans in the 20th Century”; Fite, “The Agricultural Trap in the South,” p. 46, suggests that there were insufficient non-farm occupations to absorb the surplus of southern farm labor hours that resulted from emancipation. Moreover, blacks faced more rigid hiring opportunities because the available factory jobs that were available were restricted to whites, p. 46.

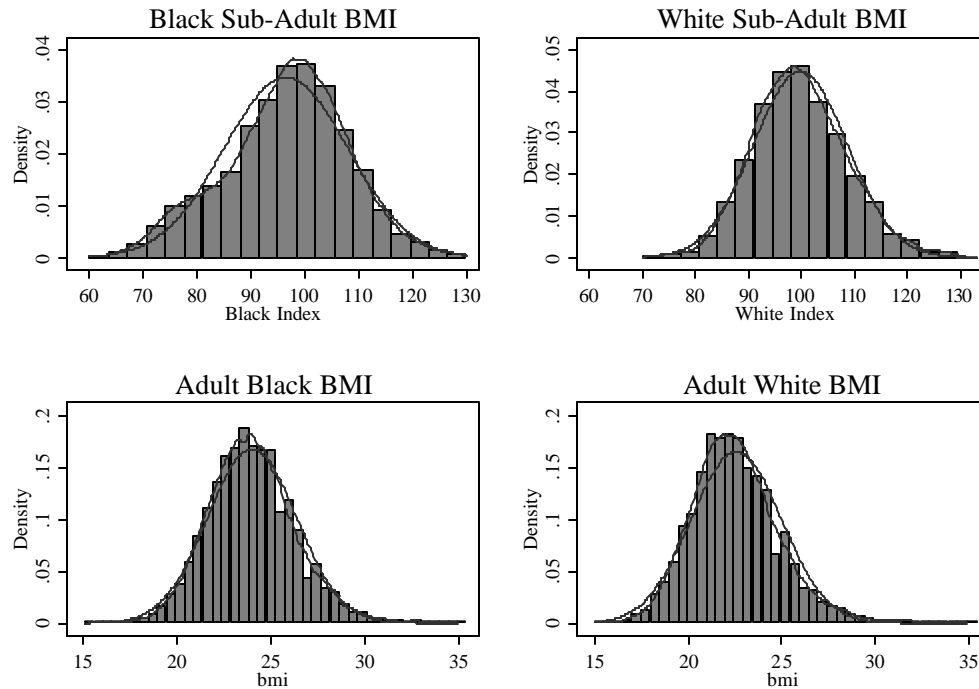
¹⁰ Steckel, “East-West Migration”; Steckel, “Household Migration and Settlement.” Higgs, *Competition and Coercion*, p. 27, indicates that before 1900 that Black migration to the Far West was infrequent.

Only a small contingent of inmates claimed European or British nativity.¹¹ Even smaller shares claimed nativities from Scandinavia, Asia or elsewhere. Among non-American inmates, it was Central and South America? predominantly Mexico? that filled the Texas prison (Carson, 2005; Walker, 1988, p. 114). Because the comparison here is between American black and white BMIs, immigrants are excluded from the analysis.

The shape of the BMI distribution tells us much about the current biological conditions facing a population. If the BMI distribution is positively skewed, there is a disproportionate number of overweight individuals, and if the BMI distribution is negatively skewed, there is a disproportionate number of underweight individuals. However, because the youth (between ages 15 and 22) BMI distribution is itself a function of the age distribution, a youth BMI index is constructed that standardizes for the effects of age. First, the average BMI for each youth age category is calculated. Second, each observation is then divided by the average BMI for the relevant age group (Komlos, 1987, p. 899). Figure 1 demonstrates that BMIs within the Texas prison were reasonably normally distributed.

¹¹ Ferrie, *Yankees Now*, pp. 35-36, 56, 58. Texas also gained the reputation for harsh criminal sentences for theft and other non-violent crimes.

Figure 1, Black and White Youth and Adult BMI Distributions



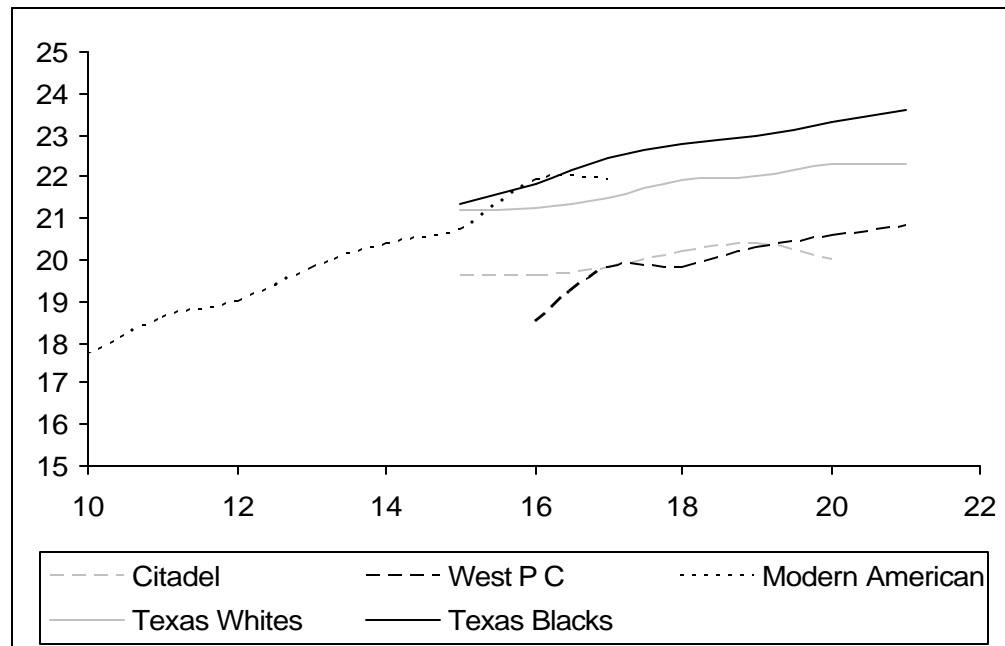
Source: See Table 1.

Note: BMI histogram compared to normal and non-parametric kernel density.

Average black youth and adult BMIs were 22.92 and 24.00, respectively. Average white youth and adult BMIs were 21.99 and 22.54, respectively, indicating that average black BMIs were heavier than average white BMIs. Black youth BMIs by age were always heavier than white BMIs (Figure 2), and the black youth BMI rate of increase with age always exceeded white youth BMI rate of increase with age. Adult black and white body mass were comparable to other well-nourished American populations with the same average age. Moreover, the percent of black and white males between the ages of 20 and 21 with BMIs below the threshold of 19—that which marks an increase in mortality risk—were only 1.6 and 3.6 percent, respectively, compared to 40 percent for West Point cadets (Cuff, 1993, p. 178), indicating that the West-Point

cadets were an undernourished sample. The average age for black and white inmates between 1870 and 1920 was approximately 30 years, and BMIs for blacks in their 30s were greater than for whites, however, both were heavier than 30 year-old Union Army veterans in 1880 and 1890 (Linares and Su, 2005, p. 370-371).

Figure 2, Nineteen Century Black and White BMI Values



Source: See Table 1; West Point Cadet comparison is from Komlos, 1987; Cuff, 1993; Komlos and Coclanis, 1995.

The relationship between age and BMI has significant implications for health, and this relationship may differ by race (Stevens, et al, 1998, p. 3-7). For 19th century Southern blacks, BMIs increased until the 40 age cohort, after which they declined (Table 3). Moreover, the standard deviation and skewness for black BMIs by age also increased until their 50s and declined in later life. However, white average BMIs and standard deviations monotonically increased with age, and white BMI skewness increased until their 70s.

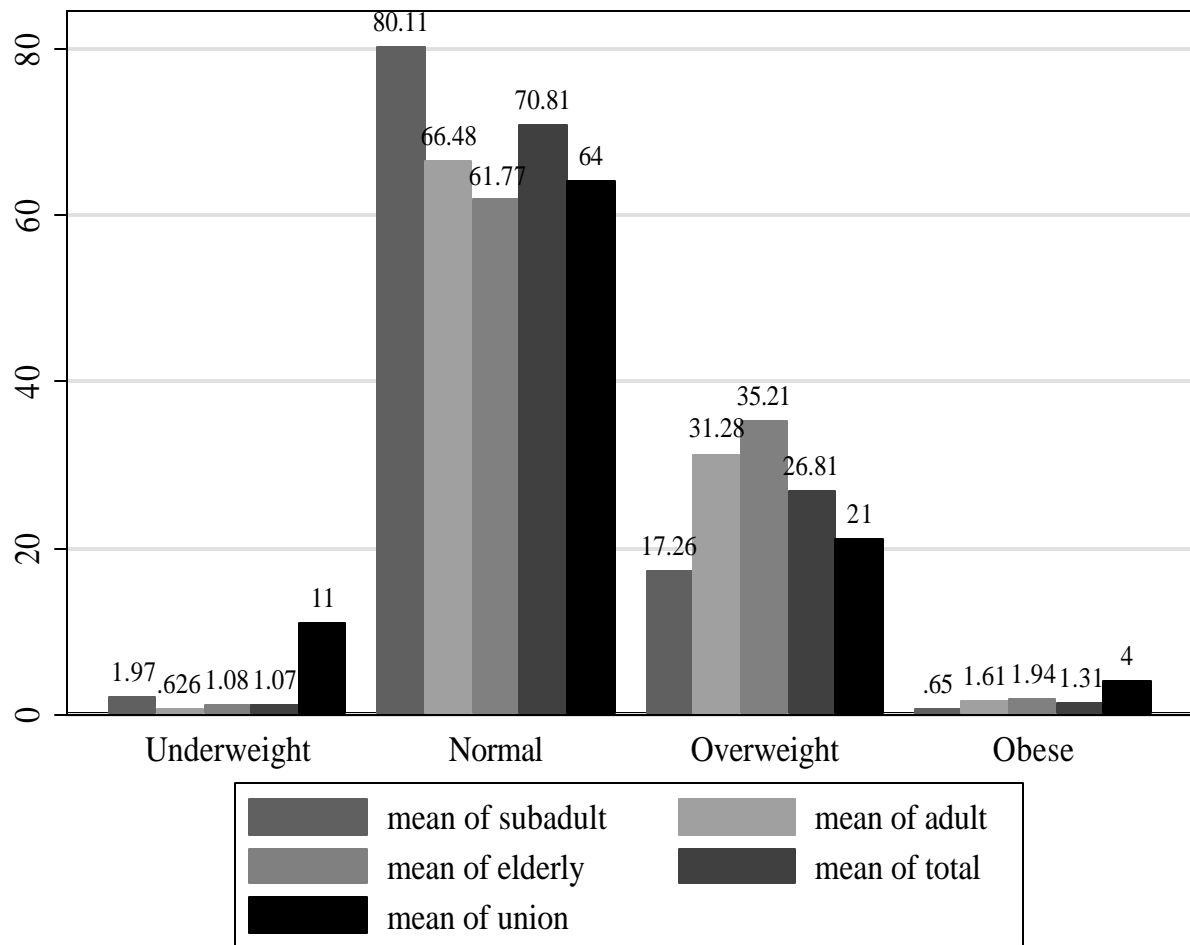
Table 3, Black and White BMI Distributions by Age

	<i>N</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Median</i>	<i>Skewness</i>
Blacks					
Teens	5,005	22.54	2.32	22.47	.190
20s	14,415	23.79	2.36	23.63	.135
30s	4,304	24.12	2.54	24.03	.337
40s	1,765	24.34	2.73	24.21	.881
50s	648	24.19	2.81	24.06	.806
60s	257	24.02	2.48	23.92	.554
70+	64	23.74	2.39	23.62	.325
Whites					
Teens	2,409	21.77	2.25	21.61	.393
20s	7,917	22.38	2.21	22.29	.275
30s	3,157	22.61	2.78	22.39	.257
40s	1,237	22.87	2.78	22.44	.968
50s	549	22.88	3.07	22.45	1.06
60s	157	23.00	3.49	22.50	2.02
70+	31	24.01	3.53	22.89	.454

Source: See Table 1.

Using the World Health Organization BMI classification coding system for modern standards, blacks and whites with BMIs less than 18.5 are considered as underweight; BMIs between 18.5 and 24.9 are normal; BMIs between 24.9 and 29.9 are overweight; BMIs greater than 30 are obese. By considering the proportions of black and white males who fell into the underweight, normal, overweight and obese categories, historical body mass data can be compared to modern standards to assess the biological and health conditions in the 19th century American South during Reconstruction. Because BMIs is sensitive to age, four groupings are considered in Figures 3 and 4: youths, adult, total sample and 19th century white Union Army veterans. Individuals 15 through 21 are classified as youths, while individuals 22 through 55 are classified as adults.

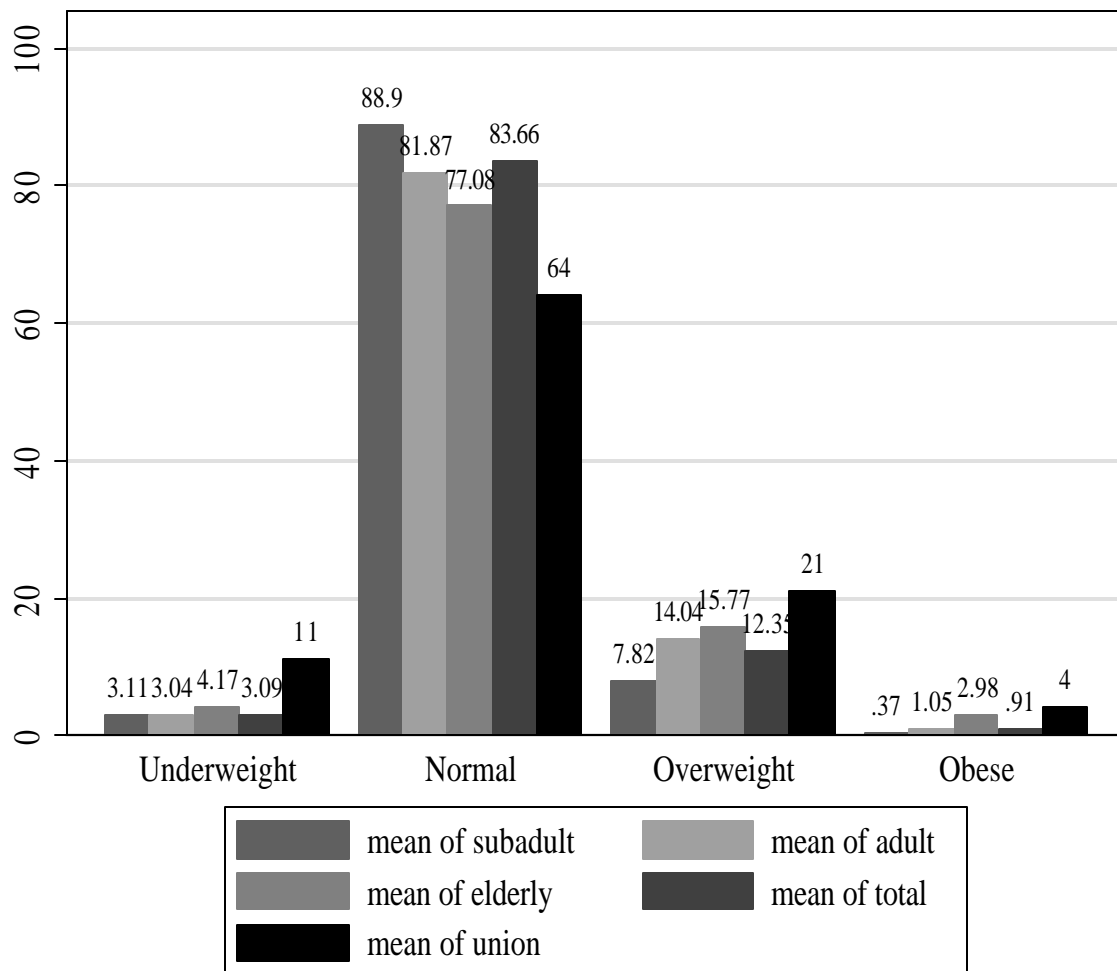
Figure 3, Black Underweight, Normal, Overweight and Obese Classifications by BMI



Source: See Table 1 for black inmates. Union Army comparison is from Linares and Su, 2005.

Notes: Individuals 15 through 21 are classified as youths, while individuals 22 through 25 are classified as adults. Elderly are men over age 55.

Figure 4, White Underweight, Normal, Overweight and Obese Classifications by BMI



Source: See Table 1 for black inmates. Union Army comparison is from Linares and Su, 2005.

Notes: Individuals 15 through 21 are classified as youths, while individuals 22 through 25 are classified as adults. Elderly are men over age 55.

Figures 3 and 4 demonstrate the overwhelming proportion of 19th century black BMIs fell within the normal BMI category; whites were even more likely to fall within the normal category. Moreover, it is striking that proportionally so many whites relative to blacks fell into the underweight category, indicating that although they came to shorter

terminal statures, blacks were less likely to be underweight. These historical BMIs are compared to modern standards, where approximately 36 percent of adult American men are overweight ($24.9 \leq \text{BMI} < 29.9$), and 23 percent obese ($\text{BMI} \geq 30$) (Sturm and Wells, 2001, p. 231; Calle, et al, 1999, p. 1103). Morbid obesity is defined as a $\text{BMI} \geq 40$, and has been linked to elevated risks of diabetes mellitus, cardiovascular disease and cancer (Pi-Sunyer, 1991, p. 1599s; Kenchaiah, 2002, p. 306-312; Calle et al, 2003, pp. 1628-1630). Cases of 19th century black and white morbid obesity in the Texas sample were nearly non-existent. Only .027 percent of blacks and .019 percent of whites in the Texas prison were morbidly obese. This contrasts with 2.9 percent in modern American samples (Steinbrook, 2004, p. 1077), which indicates that modern Americans are over 100 times more likely to be morbidly obese than inmates in the 19th century Texas prison.¹² Therefore, compared to a developed modern economy and Civil War veterans, blacks and whites in lower socioeconomic statuses were in moderate weight ranges, and morbid obesity was nearly unheard of.

3. Black and White Demographics, Occupations and BMI: a Qualitative Response Model

The underweight, normal, overweight, and obese groupings give a natural range of binary classifications for current biological conditions, indicating that an ordered logit is the appropriate polychotomous model to account for the additional information in the ordinal ranking of the BMI dependant variable. Because increased morbidity and mortality correspond with heavier BMIs, groupings are ranked in the descending order of

¹² Adult Mexican inmates also had comparable average BMIs (23.1 to 23.3) to Union Army veterans with smaller variances.

obese, overweight, normal and underweight, and the coefficient interpretation is the likelihood of being in a higher BMI classification relative to the underweight BMI baseline; least squares estimates are also presented for reference. Black and white BMI models are presented separately in Tables 4 and 5.

Table 4, Black Youth and Adult BMIs

	<i>Youths</i>		<i>Adults</i>	
	OLS	Ordered Logit	OLS	Ordered Logit
Intercept 1	16.94*	-10.52*	22.55*	-5.49*
Intercept 2		-6.97*		-2.08*
Intercept 3		-1.23*		3.73*
Age	.328*	.286*	.098*	.080*
Age ²			-.001*	-9.0 ⁻⁴ *
<i>Occupations</i>				
White-Collar	-.304	-.286**	-.526*	-.454*
Skilled	-.316***	-.259	-.478*	-.238**
Farmer	.358*	.238*	.058	.029
Unskilled	Reference	Reference	Reference	Reference
<i>Decade Received</i>				
1870	Reference	Reference	Reference	Reference
1880	-.463*	-.370*	-.418*	-.230*
1890	-.335*	.297**	-.340*	-.186*
1900	-.643*	-.606*	-.520*	-.375*
1910	-.384*	-.283*	-.532*	-.347*
<i>Crimes</i>				
Assault	.231	.344***	-.070	.037
Fraud	.259	.247	.080	.100
Murder	.260	.370***	-.136	.052
Sexual	.219	.418**	.035	.156
Theft	.178	.269**	-.046	.110
Other	Reference	Reference	Reference	Reference
<i>Region</i>				
Northeast	.887	1.55	.285	.308
Middle Atlantic	.061	-.049	.074	.110
Great Lakes	.624	.767**	-.156	-.152
Plains	.006	.451***	.279***	.224***
Southeast	.046	.135***	.108**	.066***
Southwest	Reference	Reference	Reference	Reference
Far West	.485	.466	.185	-.068
N	8,573	8,573	17,422	17,422
R ²	.0690		.0131	

Source: See Table 1.

Table 5, White Youth and Adult BMIs

	<i>Youths</i>		<i>Adults</i>	
	OLS	Ordered Logit	OLS	Ordered Logit
Intercept 1	18.18*	-8.81*	21.67*	-5.58*
Intercept 2		-5.63*		-2.75*
Intercept 3		.320		2.51*
Age	.199*	.162*	.031	.039
Age ²			-1.3	-1.7 ⁻⁴
<i>Occupations</i>				
White-Collar	.026	-.051	-.262*	-.036
Skilled	.261**	.248	-.367	-.054
Farmer	.186**	.093	.104	.094
Unskilled	Reference	Reference	Reference	Reference
<i>Decade</i>				
<i>Received</i>				
1870	Reference	Reference	Reference	Reference
1880	-.337*	-.367**	-.106	-.175***
1890	-.122	.047	.886	-.044
1900	-.242**	-.105	.138	.128
1910	-.220***	-.026	.329*	.128*
<i>Crimes</i>				
Assault	.164	.251	-.295***	-.033
Fraud	.239	.207	-.152	-.134
Murder	-.221	-.291	-.404*	-.262
Sexual	.278	.417	-.195	-.058
Theft	.125	.094	-.050	-4.1 ⁻⁶
Other	Reference	Reference	Reference	Reference
<i>Region</i>				
Northeast	-.299	.509	.598**	.425***
Middle Atlantic	.124	.006	.462*	.377*
Great Lakes	.093	.242	.500*	.355*
Plains	.249	.286	.367*	.299
Southeast	.014	-.001	.082	-.037
Southwest	Reference	Reference	Reference	Reference
Far West	.261	.136	-.037	-.434***
N	4,299	4,299	10,819	10,819
R ²	.0275		.0158	

Source: See Table 1.

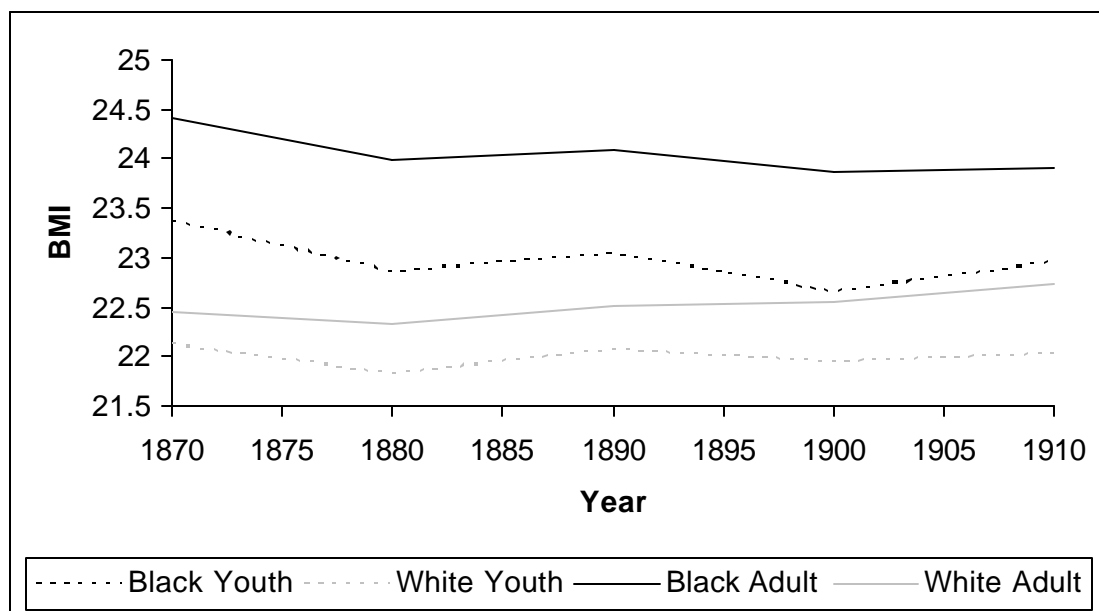
3.1 *Blacks*

Black body mass increased until age 49, after which it declined. Black white-collar and skilled workers had lower body mass than farmers and field-hands, and black farmers had the heaviest BMIs, indicating that black farmers biologically benefited from their close proximity to a nutritious food supply and mild disease environments. Black BMIs during the South's Reconstruction—as measured by the year received—declined after 1870, and the first decade of the 20th century placed the greatest biological stress on the black community. Part of the early 20th century black BMI decline was undoubtedly related to increased racial animosity and physical violence directed toward African-Americans. Black BMIs were also related to the types of crimes committed. Black youths incarcerated for murder and assaults had greater body mass than black youths incarcerated for other crimes, suggesting that larger black youths were emboldened by their size and were more likely to commit and be incarcerated for violent crimes. On the other hand, there was no systematic relationship between adult black BMIs and the types of crime committed. For the most part, there were few regional BMI differences among black males. Blacks from the Great Lakes, Plains and Southeast had greater body mass than the Southwest, indicating that blacks from the Southwest had leaner BMIs than blacks in the North. Leaner Southwestern black BMIs may reflect either greater racial animosity in the Southwest, or blacks native to the Southwest, prior to incarceration, were more likely to be employed in local labor markets, therefore, more physically active.

3.2 *Whites*

Although young white BMIs increased with age, their rate of increase was less than for blacks. Young white farmers and skilled workers had greater body mass than unskilled workers, and like blacks, young white BMIs declined throughout the late 19th century. On the other hand, adult white body mass increased throughout the 19th century, suggesting that current biological inequality between blacks and whites increased at older ages. Unlike their black counterparts, white crimes and nativity were largely unrelated to white body mass. Finally, young white BMIs were not related to nativity, and adult white BMIs in the Southwest were relatively low, indicating that workers in the Southwest were more physically active than workers not native to the area.

Figure 5, Nineteenth Century Black and White Youth and Adult BMIs

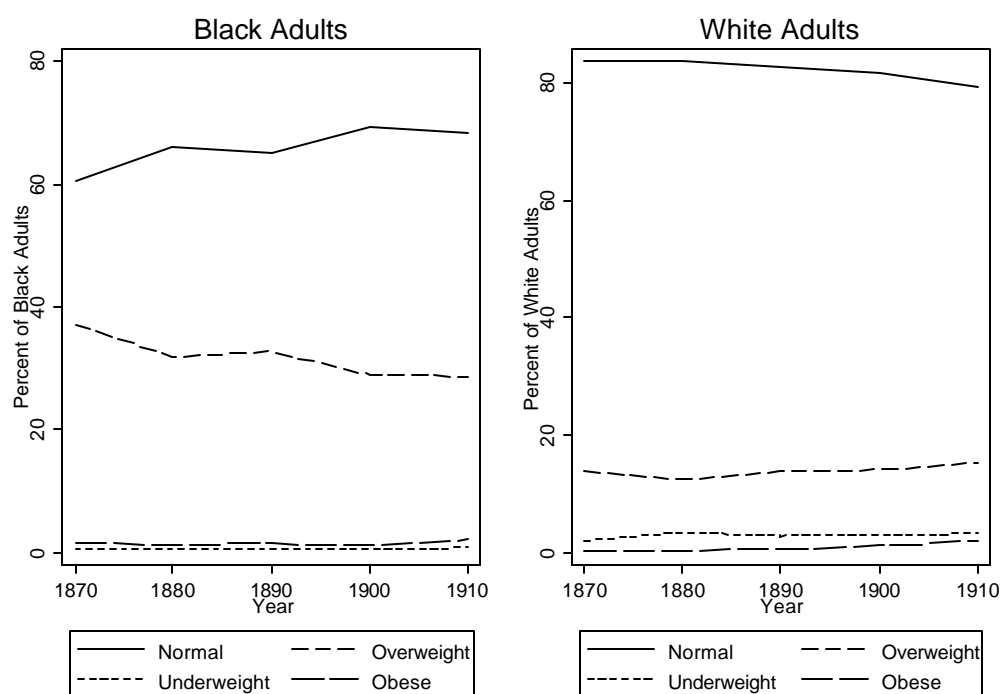


Source: See Table 1.

How BMI varied over time reflects biological disparity during the Reconstruction period, and white BMIs converged slowly with black BMIs (Figure 5). Over time black BMIs were heavier than white BMIs, which is striking since modern blacks and whites

reach comparable BMIs (Barondess, Nelson, and Schlaem, 1997, p. 968; Nelson et al., 1993, pp. 18-20; Godoy et al, 2005, pp. 472-473). Between 1870 and 1910, black BMIs decreased by .5 BMI units, and the largest declines were experienced among young blacks, placing them at increased risks of respiratory diseases and infections. Between 1870 and 1910, young white BMIs remained approximately constant, and adult white BMIs increased by .5 BMI units.

Figure 6, Nineteenth Century Black and White Adult BMI Categories



Source: See Table 1.

If health in the 19th century South improved because of improved nutrition and diet, adult proportions in the normal BMI category would have increased, and other categories declined. Figure 6 demonstrates that the adult black proportion in the normal BMI category was less than for whites but increased, and the proportion of overweight

adult blacks declined. On the other hand, the adult white proportion in the normal BMI category declined, and the proportion of overweight adult whites increased, indicating that black and white BMIs moved in alternative directions.

4. Discussion

If historical health relationships are comparable to modern health relationships, recent medical research offers new insight into lower class biological conditions in the 19th century American South. Modern studies on the relationship between age and BMI indicate that mortality risks associated with heavier BMIs may decrease with age (Stevens et al, 1998, p. 1), and remain relatively constant between ages 30 and 74 but decline during older ages (Stevens et al, 1998, p. 3). Nevertheless, for all age groups, except the very oldest, heavier BMIs are associated with increased mortality from all mortalities and from cardiovascular diseases (Stevens, 1998, p. 5; Calle et al, 2003, pp. 1628-1637; Calle et al. 1999, pp. 1101-1103; Kenchaiah et al, 2002, pp. 306-307). White BMIs in the Texas sample increased with age. Consequently, adult white health likely improved in the late 19th and early 20th centuries, but adult whites probably experienced greater rates of heart disease as they grew older (Barker, Osmond and Golding, 1992, pp. 86, 90). Moreover, the 19th century BMI increase with age in Southern whites also indicates that gallbladder disease, arthritis, gout, pulmonary function and diabetes mellitus likely increased over time (Pi-Sunyer, 1991, pp. 1597s-1600s). Alternatively, Southern black BMIs only increased through their 40s, and

declined in older ages. If optimal BMI increases for older ages,¹³ Southern black BMIs demonstrate an alarming trend. When able to work, Southern blacks in the 19th century acquired heavier BMIs during prime working ages; however, when they were no longer productive and exited the labor force, their BMIs declined, and older black males became more vulnerable to infectious, cerebrovascular diseases, and pneumonia (Calle et al, 1999, p. 1101; Livi-Bacci, 1983, p. 294).

The link between socioeconomic status and BMI indicates that both black and white agricultural workers consistently had heavier BMIs than other workers, and indicates that farmers were healthier during younger ages but may have become more vulnerable to cardiovascular disease and stroke as they aged, especially since farmers had greater access to animal fats and whole milk. One noted exception is that young Southern white workers in skilled occupations were noticeably heavier than workers in other occupations, which suggests their physical inactivity in sedentary skilled occupations led to excess weight gain. Young skilled whites used between 1.5 and 2.5 energy requirement multiples of sleeping basal metabolic rate. Young agricultural workers used between 2.5 and 6.8 energy requirement multiples of sleeping basal metabolic rate (FAO/WHO, 1985, pp. 77-78, 186-191; Fogel, 1994, p. 372). Therefore, if young whites consumed high calorie diets meant for physical activity as they integrated into clerical occupations that required fewer calories, young whites in skilled occupations likely experienced weight gain.

¹³ There continues to be debate over the optimal BMI for different age groups. Calle et al, 1999, p. 1103) indicate there is a single recommended weight range throughout life, while Stevens et al (1998, p. 1) indicate that the relative mortality risk associated with heavier BMIs decline with age.

The influence of nativity indicates that all Southwestern blacks and whites were leaner than their counterparts from other regions. This effect is difficult to interpret. Leaner Southwestern black BMIs are consistent with reduced access to occupational opportunities and renewed racial violence against blacks in the Southwest. However, whites from the Southwest were also leaner than their Northern counterparts, which indicates that leaner BMIs for both blacks and whites likely resulted from greater physical activity, because individuals from the Southwest were integrated into economic and social networks, which allowed them greater employment opportunities and physical activity.

Finally, modern studies in adult adiposity may even shed light on biological conditions when these adults were in utero, consequently, may reflect maternal conditions under slavery. Modern studies demonstrate that there is an inverse relationship between birth weight and the adult risk of central obesity, especially if there is significant catch-up growth in the first years of life (Heindel, 2003, p. 247). There may also be a U or J shaped relationship between adult obesity risk and undernourished or obese mothers (Haslam and James, 2003, p. 1201; Kiple, 2002, pp. 132-133). These biological imprintings on slave babies born to emaciated or obese mothers may have contributed to greater body weight among adult blacks during the Reconstruction period. These complex relationships between BMI, birth weight and mother's weight—that are not fully understood—augment traditional stature and BMI studies to reflect black biological conditions under slavery and Reconstruction, indicating that modern African-America health outcomes may be rooted in historical processes.

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