



DOES MUSCLE PAY? GENDER DIFFERENCE IN THE LABOR MARKET RETURNS TO BODY COMPOSITION

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Abstract

This paper studies whether muscle strength affects the labor market outcomes and whether any gender difference presents in the effect. Based on the data from the National Health and Nutrition Examination Survey (NHANES) from 2013 to 2014, this paper employs regression analysis methods to estimate how various body composition indicators are related to income and employment. Unlike previous studies that mainly relied on Body Mass Index (BMI) as a weight indicator, this paper introduces functional strength indicators such as muscle mass and grip strength to measure physical ability more comprehensively. The research results show that there is no significant correlation between traditional weight indicators and income and employment, while there is a relatively stable positive correlation between grip strength and the labor market outcomes. Meanwhile, the analysis found that the correlation was more significant among males, while the results among females were relatively weak.

Keywords

Body Composition, Income, Employment, Gender Differences

1. Introduction

In labor economics, income disparity is usually attributed to factors such as education, human capital, and experience, but an individual's physical characteristics may also have economic value. As the economic structure shifts from manufacturing industries to the service sector, the implicit demands of the labor market for image, health, and energy levels may rise. However, most existing studies use BMI as a health indicator, making it difficult to distinguish the differences between fat and muscle. Meanwhile, the obesity rate among American adults is close to 40%, and the participation rate in fitness and strength training continues to rise, indicating that body composition has become a widely discussed social phenomenon. BMI, as a weight-to-height ratio, fails to capture lean muscle mass and therefore provides a poor proxy for muscular fitness or physical capacity (Bozoyan & Wolbring, 2011). Under this background, it is of great research significance to examine whether precise muscle indicators are related to labor market outcomes.

To explore whether muscle strength is related to labor market outcomes, this paper provides empirical evidence using regression analysis. The study utilized data from the National Health and Nutrition Examination Survey (NHANES) from 2013 to 2014 to construct a basic regression model and an extended model that incorporated population and socioeconomic control variables, including age, gender, and educational level. The core independent variables cover a variety of body composition and strength indicators, including appendicular lean mass (ALM) of the limbs, muscle mass index (ALM_h2), fat-to-muscle ratio (FMR), grip strength (CombinedGripStrengthKG), and BMI. By introducing multi-dimensional muscle and functional strength measurement indicators, this study aims to break through the limitation of using only BMI to measure physical condition.

The dependent variables of this article include employment status and income. The robustness of the correlation between muscle indicators and economic outcomes is evaluated by comparing the model results with or without control variables.

The results show that traditional body weight indicators (such as BMI) and the fat-to-muscle ratio do not exhibit a stable and statistically significant relationship with Income or employment status. In contrast, indicators reflecting muscle mass and functional strength, especially grip strength, show a more robust positive correlation with labor market outcomes. Furthermore, the analysis also revealed significant gender differences: the correlation of strength-related indicators was more pronounced in male samples, while the results were relatively unstable in female samples. The above findings emphasize that when studying the relationship between physical condition and economic outcomes, it is necessary to distinguish different types of physical measurement indicators.

Existing research has explored the relationship between physical characteristics and socio-economic outcomes from multiple perspectives. Judge and Cable (2011) found, based on longitudinal data from the United States and Germany, that there were significant gender differences in the weight-income relationship: Women often face wage penalties in higher weight ranges, while men may gain income advantages within a certain weight range, but this is negatively affected when they are obese. This study emphasizes the gender heterogeneity of physical evaluation in the labor market.

Bozoyan and Wolbring (2011) pointed out that BMI, as an indicator of obesity, has measurement bias, and proposed that fat-free mass (FFM) and body fat (BF) are more explanatory in explaining wage differences. They found that in simple linear models, FFM was positively correlated with salary, while BF was negatively correlated. However, this relationship was not robust in fixed-effects models.

At the social and cultural level, Dworkin (2001) proposed that women face the "glass ceiling" phenomenon in fitness and strength training; that is, social norms impose structural restrictions on the upper limit of women's muscle development. Messing (1982) criticized the view that "biological differences" were used as a rationalization tool for "job allocation", noting that gender differences were often used to provide a legitimate explanation for wage inequality.

Furthermore, Benton and Karazsia (2015) found that exposure to thin and muscular images would reduce the body satisfaction of women. Lubans and Cliff (2011) pointed out that there are significant gender differences in muscular strength, body composition, and physical self-perception.

Overall, existing literature suggests that physical characteristics may affect labor market outcomes. However, most studies still mainly rely on BMI or body weight indicators, and rarely include muscle mass indicators and functional strength measures for systematic comparison simultaneously.

This paper contributes to the existing literature in the following aspects. Firstly, most existing labor economics studies use BMI or body weight as physical measurement indicators. However, this paper introduces multiple muscle mass indicators (such as ALM, ALM h2) and functional strength indicators (such as grip strength) to more accurately measure body composition. Secondly, this paper compares the relationships between different physical indicators and Income as well as employment within the same data framework and systematically tests their robustness. Additionally, this paper further conducts regression analyses on male and female samples, respectively, to explore whether there is gender heterogeneity between physical ability and economic outcomes. Therefore, this paper not only supplements empirical evidence on the relationship between body composition and income but also provides a new perspective for understanding the potential role of gender norms in the economic returns of the body.

2. Research Methods

To explore the relationship between body composition indices and the labor market outcomes, I use regression analysis as the research method.

I first use a basic regression model to start the estimation, following equation (1):

$$Y_{it} = \beta_0 + \beta_1 * X_{it} + \epsilon_{it} \quad (1)$$

In this formula, X_{it} refers to the measurements of muscle strength of individual i in year t , which involves five methods of measurement. Y_{it} refers to the outcome variables, including the income-related variables like employment and Income. β_1 is the coefficient, indicating the correlation between x and Y_{it} . ϵ_{it} is the residual, referring to the error term in this equation.

Since the labor market outcomes are related to a series of demographic characteristics, I estimate a second model that includes additional control variables, following equation (2):

$$Y_{it} = \beta_0 + \beta_1 * X_{it} + \beta_2 * Z_{it} + \epsilon_{it} \quad (2)$$

Compared to equation (1), this equation adds Z_{it} as control variables, including age, gender, and college education. The coefficient, β_2 , shows the correlation between Z_{it} and Y_{it} .

3. Data

This research uses data collected from the National Health and Nutrition Examination Survey of the 2013-2014 cycle, which measures the health and nutrition of adults and children in the United States. Data from this research comes from health exams and laboratory tests for national representatives of all ages.

In this paper, the labor market outcomes are measured by two variables: Employment and Income. Income is a variable created by the calculation using RatioOffFamilyIncomeToPoverty times \$11,670, the federal poverty line of a single person household of 2013-2014. RatioOffFamilyIncomeToPoverty represents a ratio of family income to poverty guidelines. The higher this variable, the wealthier a family is. This research only selects families that include only one individual to ensure this variable represents the personal income. This variable's unit is dollars. The other labor market outcome measure is employment, which equals 1 if a person is employed and equals 0 if otherwise.

This paper adopted five measurements for assessing the body composition: ALM, ALM_h2, FMR, CombinedGripStrengthKG, and BMI.

ALM stands for appendicular lean mass, calculated by leanmass*0.88, which indicates the raw quantity of muscle an individual has for working and acting. The higher the value of ALM, the more muscle a person has in their body.

ALM_h2 represents the muscle index - meaning the amount of muscle a person has under the same height relatively - and is calculated using ALM/height². A higher ALM_h2 value indicates a higher relative muscularity; this measurement makes the comparison between people of different heights possible.

FMR is short for Fat-to-Muscle Ratio, calculated by TotalFatg/(leanmass*0.88). This measurement can effectively assess whether an individual is fat-dominant or muscle-dominant. The higher value of FMR means higher fat and lower muscle.

CombinedGripStrengthKG measures the functional muscle strength, which is considered the physical capability. To be specific, it's a measure of the sum of the highest grip strength values recorded from both hands using a handheld dynamometer, which unit is kg.

These four measurements work together from four dimensions, involve the structure of the body, relative comparison of muscle indexes, ratio of body construction, and muscle's functional strength, to explicitly and fully determine whether a person is muscular.

To ensure this research focuses only on how being muscular can affect the individual's income, control variables are set into the analysis. For the demographic aspect, age and gender are set as controlled variables. And for the socioeconomic background dimension, education level is taken into consideration. Specifically, this research creates a new variable college, which stands for whether or not the individual has an education level of or above college.

This paper adopted data from the 2013-2014 cycle of NHANES, which contains plenty of measurements to measure the extent of muscular strength. Several standards are set to select samples that meet the requirements of the research: The observations should be adult, meaning their ages should be 18 or above 18; These samples should have both data about their income and muscular level. For those who have part of the research data but miss the others, or those who don't meet the requirements, this research excludes them and keeps the rest. The initial sample size of the whole 2013-2014 cycle dataset is 10,175, and after the sample selection process, the final sample size ranges from 523 to 700.

Table 1: Summary Statistics

	(1) Mean	(2) Standard deviation	(3) Minimum	(4) Maximum
Age	42.23	14.56	18	65
Gender	.5858	.4929	0	1
College	.6387	.4807	0	1
BMI	28.46	7.67	15.2	74.1
Employment	.6776	.4677	0	1
RatioOffFamilyIncometoPoverty	2.176	1.722	0	5
AnnualFamilyIncome	5.419	3.901	1	15
Income	25393.11	20094.08	0	58350
FMR	.5621	.2255	.2080	1.2589
ALM	19170	4633	9429	37580
ALM_h2	6.530	1.192	3.741	11.230
CombinedGripStrengthKG	78.02	22.22	22.6	162.8

Note: N=4,449. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014.

Table 1 presents summary statistics, including the mean, standard deviation, minimum, and maximum of all dependent and independent variables. The mean age of participants, ranging from 18 to 65 years old, is 42 years. 58.58% of the samples are males, and 63.87% of the samples have an education level of or above college level. The employment rate of the samples is 67.76%. The mean rate of RatioOffFamilyIncometoPoverty is 2.176, meaning the average income level of the samples is lower-middle; the minimum of this variable is 0, and the maximum is 5, reflecting the wide range of income levels between absolute poverty and the wealthy. The AnnualFamilyIncome is 5.419, meaning the average annual income of the samples is between the range of \$20,000 and \$24,999. The average value of Income is 25,393.11 dollars per year.

The ALM mean value is 19,170g (around 19.2kg), while normally a female has an ALM between 15 and 18kg and a male has an ALM between 20 kg and 25kg. The mean Fat-to-Muscle Ratio is 56.21%; mean of ALM_h2 is 6.530; and the CombinedGripStrengthKG's mean value is 78.02kg.

4. Results

Table 2 examines the relationship between BMI and Income and Employment. The standard error of each regression analysis is included in parentheses. Column (1) presents the basic regression results on Income with 662 samples, as shown in equation (1). The result shows that when BMI increases by 1 kg/m², Income increases by \$142.90. The effect is statistically insignificant. And 0.30% of the variation in this income variable can be explained by BMI. Column (2) shows the regression result with control variables, including age, gender, and college education, where Income increases by \$50.77 if BMI increases by 1 kg/m², and that these two variables are also statistically insignificant. The sample size of this model is 617, and the R-squared value is 0.1004. Column (3) indicates that a 1 kg/m² increase in BMI results in a decrease of 0.00283 in employment and a decrease of 0.00185 in employment when control variables are included in Column (4). Both of the regression results show a statistically insignificant result between BMI and employment. Specifically, among the 700 samples with no control variables, 0.22% of the variation in employment is explained by BMI, and 7.83% of the variation in employment is explained by BMI with a sample size of 652 with control variables. Overall, no significant relationship presents between BMI and the labor market outcomes.

Table 2: Regression analysis of BMI, Income and employment

	(1)	(2)	(3)	(4)
	Income		Employment	
BMI	142.90 (101.22)	50.77 (100.07)	-0.00283 (0.00230)	-0.00185 (0.00226)
Control Variables	N	Y	N	Y
R squared	0.0030	0.1004	0.0022	0.0783
N	662	617	700	652

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. BMI represents Body Mass Index, calculated using $\text{weight}/\text{height}^2$. Control variables include Age, Gender, and College (college education attainment).

Table 3 assesses the correlation between FMR and Income and Employment. In the basic regression models of FMR and two labor market outcome variables (Columns (1) and (3)), one unit of increase in FMR is followed by a \$13,13.43 increase in Income with 567 samples and a 0.133 decrease in employment with 593 samples. Both regression results indicate a statistical insignificant relationship between FMR and the two income-related variables. 0.02% of variation in Income and 0.43% of variation in Employment are explained by FMR. Additionally, the regression models of Columns (2) and (4), using equation (2) with control variables, show statistically insignificant correlation between FMR and the other two variables. There are 523 samples in the regression result of Column (2). The one-unit increase in FMR leads to a \$405.83 decrease in Income. The R-squared value in this model is 0.1036. And there are 547 samples in the regression result of Column (4). As FMR increases by 1, employment decreases by 0.0176. The R-squared of this model is 0.0644.

Table 3: Regression analysis of FMR, Income and employment

	(1)	(2)	(3)	(4)
	Income		Employment	
FMR	1313.43 (3790.27)	-405.83 (4995.20)	-0.133 (0.0834)	-0.0176 (0.111)
Control Variables	N	Y	N	Y
R squared	0.0002	0.1036	0.0043	0.0644
N	567	523	593	547

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. FMR represents Fat-to-Muscle Ratio, calculated using $\text{TotalFatg}/(\text{leanmass} \times 0.88)$. Control variables include Age, Gender, and College (college education attainment).

Table 4 presents the effects of ALM_h2 on Income and Employment. In the analysis of the correlation between ALM_h2 and Income, while there are no control variables, Column (1) shows a statistically significant result between the two variables among 572 samples. 2.11% of the variation in Income is explained by ALM_h2, and as ALM_h2 increases by 1 kg/m^2 , Income increases by 2473.35. Differently, Column (2) shows no statistically significant relationship between Income and ALM_h2 while control variables are set. The R-squared value is 0.111, and the sample size is 528 for Column (2). If ALM_h2 increases by 1 kg/m^2 , Income increases by \$995.13. Additionally, among the 598 samples of research between ALM_h2 and employment in column (3), the R-squared value is 0.0072, and the coefficient of the basic regression model equation (1) is 0.0000328. These two variables are indicated to have high statistical significance. And Column (4) shows low statistical significance between the two variables when controlled by the other variables. The coefficient of the equation (2) applied to the regression model of Column (4) is 0.0000169; the sample size of this regression analysis is 552; and 6.96% of the variation in employment is explained by ALM_h2.

Table 4: Regression analysis of ALM_h2, Income and employment

	(1)	(2)	(3)	(4)
	Income		Employment	
ALM_h2	2473.35*** (705.43)	995.13 (765.15)	0.0000328*** (0.0000158)	0 .0000169* (0.000017)
Control Variables	N	Y	N	Y
R squared	0.0211	0.111	0.0072	0.0696
N	572	528	598	552

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. ALM_h2 represents muscle index, which means the amount of muscle a person has under the same height relatively, calculated using $ALM/height^2$, the unit is kg/m^2 . Control variables include Age, Gender, and College (college education attainment).

Table 5 reflects the relationship between ALM and Income and Employment. Both of the regression models of Columns (1) and (2) show high significance between ALM and Income. In the basic regression equation (1) applied to Column (1), which includes 572 samples, the coefficient between ALM and Income is 0.7305, and the R-squared value is 0.0280. When there are controlled variables, the coefficient of equation (2) applied to Column (2) is 0.4454, the sample size of this model is 528, and the R-squared value is 0.115. Similarly, the regression model with 598 samples of Column (3) shows high significance between ALM and employment. When ALM increases by 1g, employment increases by 0.0000112. 1.27% of the variation in employment is explained by ALM. Differently, Column (4), with 552 samples under control variables, shows no indicator of statistical significance between ALM and employment. The coefficient of equation (2) applied to this column is $5.31e-06$, and the R-squared value is 0.0699.

Table 5: Regression analysis of ALM, Income and employment

	(1)	(2)	(3)	(4)
	Income		Employment	
ALM	0.7305*** (0.1804)	0.4454** (0.2224)	0.0000112*** (4.05e-06)	$5.31e-06$ (4.95e-06)
Control Variables	N	Y	N	Y
R squared	0.0280	0.115	0.0127	0.0699
N	572	528	598	552

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. ALM represents appendicular lean mass, calculated using $leanmass*0.88$, the unit is gram. Control variables include Age, Gender, and College (college education attainment).

Table 6 shows how CombinedGripStrengthKG affects Income and Employment. All regression analyses of the four columns indicate the high statistical significance between CombinedGripStrengthKG and two income-related variables. In Column (1), the basic regression model with equation (1) has a coefficient of 192.74, and 4.56% of variation in Income is explained by CombinedGripStrengthKG. The control variables are not taken into the regression model of Column (1) with 632 samples. In Column (2), which contains controlled variables and 587 samples, the coefficient of equation (2) of the regression model is 262.69, and the R-squared value is 0.141. Then, for regression analysis of the relationship between CombinedGripStrengthKG and employment, employment increases 0.00513 in the model of Column (3) and 0.00549 in the model of Column (4) when CombinedGripStrengthKG increases by 1 kg. There are 667 samples in Column (3) and 620 samples in Column (4). R-squared value of Column (3) is 0.0597, and R-squared value of Column (4) is 0.118 under controlled variables.

Table 6: Regression analysis of CombinedGripStrengthKG, Income and employment

	(1)	(2)	(3)	(4)
	Income		Employment	
CombinedGripStrengthKG	192.74*** (35.15)	262.69*** (49.45)	0.00513*** (0.000790)	0.00549*** (0.00111)
Control Variables	N	Y	N	Y
R squared	0.0456	0.141	0.0597	0.118
N	632	587	667	620

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. CombinedGripStrengthKG is a measure of the sum of the highest grip strength values recorded from both hands using a handheld dynamometer, and the unit is kg. Control variables include Age, Gender, and College (college education attainment).

Overall, the results showed that there are significant differences in the impact of different physical indicators on labor market outcomes. Neither BMI nor FMR showed a statistically significant relationship with Income or employment, indicating that simple weight or fat ratio alone cannot effectively explain the performance of the labor market. However, indicators related to muscle mass (such as ALM and ALM_h2) were significant in some models, but their significance weakened after the addition of control variables, indicating that their influence might be influenced by other individual characteristics. Lastly, CombinedGripStrengthKG showed a stable and significant positive relationship in all models and remained significant even after the addition of control variables. This indicates that, compared with body shape indicators, muscle strength indicators reflecting physical functional abilities may be more correlated with income and employment status.

This research also assesses the relationship between income and several indicators of strengths separately among male and female. All the results presented are estimated using equation (2), which includes control variables. The standard errors are recorded in parentheses.

Table 7 demonstrates the correlation between income and five strength measurements, arranged in five columns. Column (1) presents the relationship between Income and FMR for both males and females separately. When FMR increases by 1 unit, the income of males increases by \$887.17, but the income of females decreases by \$2,696.71 dollars. As FMR refers to Fat-to-Muscle Ratio, when the mass of fat stays unchanged, the increase in muscle mass of women is positively associated with higher income levels.

Columns (2) and (3) show the relationship between Income and two physical strength indicators, ALM and ALM_h2, of two genders. The columns show significance between ALM_h2 and male income, and high significance between ALM and male income. Differently, female income has no significant correlation with these muscle measurements. As ALM increases by 1 kg, male income increases by \$0.6088, female income increases by only \$0.1260; both indicate that the increase in mass of muscles is positively related to the increase in incomes of both genders. As ALM_h2 increases by 1 kg/m², male income increases by \$1,815.79, and female income decreases by \$178.45.

Column (4) shows the correlation between Income and CombinedGripStrengthKG: the relationship of males indicates a high significance, and the relationship of females indicates significance. As CombinedGripStrengthKG increases by 1kg, male income increases by 261.92 dollars, and female income increases by 256.13 dollars. Both relationships demonstrate a positively correlated relationship between physical muscle and income.

Column (5) demonstrates the relationship between Income and BMI; both genders show no significance of the relationship. When BMI increases by 1 unit, the income of males increases by 237.26 dollars. However, the income of females decreases by 112.80 dollars. This pattern may reflect different conditions for different genders. For males, the stronger the build, the higher they may earn, but for females, the larger the value of mass divided by the square of height, the lower they may earn.

Table 7: Gender-specific regression analysis of five physical measurements and income.

	(1) FMR	(2) ALM_h2	(3) ALM	(4) CombinedGrip StrengthKG	(5) BMI
Male	887.17 (7404.61)	1815.79* (1001.16)	0.6088** (.2742)	261.92*** (56.28)	237.26 (151.93)
R squared	0.1131	0.1261	0.1306	0.1654	0.1236
N	318	321	321	351	365
Female	-2696.71 (6821.22)	-178.45 (1185.34)	0.1260 (0.3787)	256.13** (103.63)	-112.80 (133.62)
R-squared	0.1046	0.1058	0.1062	0.1023	0.0817
N	205	207	207	236	252

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. Control variables include Age, Gender, and College (college education attainment). All models include control variables.

Table 8 presents the relationship between employment status and all five physical strength indicators, arranged in five columns. Column (1) shows the correlation between FMR and employment. Both genders show no significance. As the FMR increases by 1 unit, the probability of getting employed decreases by 0.17 for men, but increases 0.098 for women.

Columns (2) and (3) present the relationship between ALM_h2, ALM, and employment status. Both physical measurements show no significance with employment status for the two genders, and the two genders share a similar pattern of the relationships. As ALM_h2 increases, both employment probabilities increase: 0.0175 units for men and 0.01559 units for women. The correlation between ALM and employment also shows a positive relationship, with 4.30e-06 for males and 6.99e-06 for females.

Column (4) demonstrates the highly significant relationship between CombinedGripStrength and employment status. As this physical measurement increases by 1 kg, men's employment probability increases by 0.0044 units, and women's employment probability increases by 0.00936 units. These show the positive correlation between strengths and employment status.

Column (5) shows the negative and not significant relationship between BMI and employment status for both genders: male employment status decreases by 0.0012 units, and female employment status decreases by 0.0026 units when BMI increases by one unit.

Table 8: Gender-specific regression analysis of five physical measurements and employment status.

	(1) FMR	(2) ALM_h2	(3) ALM	(4) CombinedGrip StrengthKG	(5) BMI
Male	-0.17 (0.1610)	0.0175 (0.02173)	4.30e-06 (6.00e-06)	0.0044*** (0.0012)	-0.0012 (0.0032)
R squared	0.0816	0.0788	0.0784	0.1161	0.0887
N	337	340	340	377	391
Female	0.098 (0.1578)	0.01559 (0.02741)	6.99e-06 (8.72e-06)	0.00936*** (0.0024)	-0.0026 (0.0032)
R-squared	0.0446	0.0535	0.0550	0.1186	0.0567
N	210	212	212	243	261

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. Data are from the National Health and Nutrition Examination Survey (NHANES) 2013-2014. Control variables include Age, Gender, and College (college education attainment). All models include control variables.

After conducting regression analysis by gender separately, the results of Tables 7 and 8 show that there were significant differences in the relationship between physical indicators and income among different genders. Overall, the correlation of strength-related variables is more significant and stable in the male sample. Specifically, there is a significant positive correlation between muscle mass indicators and

CombinedGripStrengthKG and male income, while in the female sample, most muscle-related indicators do not show robust statistical significance. In contrast, grip strength is the only indicator that shows a relatively stable positive correlation in both male and female samples. The above results indicate that the association between physical ability and labor market outcomes may differ by gender. However, these regression results only reflect the correlation and cannot be used to infer causal effects.

5. Conclusion

The results of this study show that traditional body weight indicators (such as BMI) and the fat-to-muscle ratio do not exhibit a stable and statistically significant relationship with Income or employment status. In contrast, indicators reflecting muscle mass and functional strength, especially grip strength, show a more robust positive correlation with labor market outcomes. Furthermore, the analysis also revealed significant gender differences: the correlation of strength-related indicators was more pronounced in male samples, while the results were relatively unstable in female samples. The above findings emphasize that when studying the relationship between physical condition and economic outcomes, it is necessary to distinguish different types of physical measurement indicators.

Although this study provides new empirical evidence, there are still several limitations. Firstly, this paper conducts an analysis based on cross-sectional data and is unable to identify a clear causal relationship. The current results only reflect the correlation between variables and cannot rule out the possibility of reverse causal relationships. For instance, income levels may affect an individual's nutritional status, exercise opportunities, or access to fitness resources, thereby influencing body composition.

Secondly, although this article employed relatively precise muscle and strength indicators, it still failed to fully capture the long-term physical changes of an individual. The body composition has dynamic characteristics, but this study only observed data at a certain point in time and was unable to determine the persistence of the body condition and its long-term economic impact.

Besides, this article does not make a detailed distinction among different occupational categories or industry characteristics. The demands for physical strength or external appearance vary greatly among different occupations, and the relationship between body composition and labor market outcomes may be heterogeneous across different positions. The lack of detailed analysis at the professional level limits further explanation of the mechanism.

Finally, the sample only covers specific years, and the stability of the research results in the time dimension still needs to be verified.

From a policy perspective, if there is a stable correlation between physical composition and labor market outcomes, then physical health is not merely a medical or public health issue, but may also be related to economic productivity and income distribution structure. This means that policies that promote physical activity and improve body composition may have spillover effects that go beyond health itself. For instance, the government can enhance the opportunities for different income groups to participate in strength training and sports activities by increasing the supply of public sports facilities, improving the community sports environment, and lowering the threshold for accessing fitness resources. Such policies may not only help reduce obesity rates and the risk of chronic diseases in the long term, but also enhance individuals' ability to participate in the labor market and their economic performance.

Furthermore, if the connection between physical composition and employment or income partly reflects implicit preferences or external image effects in the labor market, then policymakers should also pay attention to potential inequality issues. Low-income groups are often at a disadvantage in terms of access to health resources. If their physical condition further affects their labor market opportunities, it may exacerbate the cycle between "health and income". Therefore, in the design of public policies, it is possible to consider integrating health promotion measures with social security policies, such as providing exercise subsidies or health intervention programs in low-income communities, to alleviate the economic consequences that may arise from health disparities.

Meanwhile, this study also suggests that physical health can be regarded as a broad form of human capital. Traditional human capital investment has mainly focused on education and skills training, while neglecting the potential role of physical condition in productivity. If future research further confirms this correlation, policy discussions may be able to understand the composition of "human capital" from a more comprehensive perspective.

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