The relationship between BMI, lifestyle, and dietary preferences of childbearing age women

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Abstract. The health of childbearing-age women has attracted much attention from society, among which Body Mass Index (BMI) is an important index to evaluate physical health. Meanwhile, age, race, education, parity the frequency of exercise, lifestyle, and diet structure may also have a potential impact on physical health, and there are few studies in this area. The primary objective of this research is to ascertain whether there is an association between BMI and the above factors in women of both races. A data set of women who are residents of Birmingham was collected through questionnaires and analyzed statistically. The results showed a significant linear relationship between BMI and some factors. The study also found that the AA race had more BMI, education, calories, and lower rates of smoking and sugar intake; Smokers are more likely to be educated, have lower BMIs, exercise more often, and have higher sugar and alcohol intake. For women with less education, they have more children with a higher prevalence of smoking. In terms of diet, they followed a high-calorie diet that contained more sugar but less protein. In summary, it is recommended to provide women with lower education levels and smokers with basic nutrition, exercise, and smoking hazards education to improve overall health. Women of childbearing age should pay attention to moderate exercise in daily life and reasonable allocation of intake ratio of key elements to maintain health, which has important implications for improving quality of life and preventing chronic diseases.

Keywords: Childbearing age, BMI, Race, Level of educational, Smoke status.

1. Introduction

These days, obesity has become one of the major problems in global health. In 2022, about 2.5 billion adults aged 18 and above were overweight, which consisted of more than 890 million obese people. It indicates that 43 percent of grown-ups 18 and older (43 percent of men and 44 percent of women) were overweight with a rise from 1990 when 25 percent of adults 18 and older were overweight. In the United States and many other wealthy countries, the biggest nutrition-related problem is excessive body fat. Excess obesity causes about 30-40% of heart disease, many types of cancer, most adult-onset diabetes, and a significant proportion of disabling osteoarthritis [1]. While obesity is linked to genetic factors, it is clear that diet and lifestyle factors are the main causes of high body fat in the population. It is often said that dietary fat is one of the crucial lifestyle factors contributing to high obesity rates. For example, the prevalence of obesity among Japanese men living in San Francisco is three times higher than among men living in Japan. Reducing obesity often suggests reducing the amount of fat in the diet [2].

In recent years, there has been a notable elevation in living standards accompanied by a transformation in lifestyles. More and more women have paid attention to their weight and figure, hoping to maintain a healthy body through reasonable diet and exercise. For women of childbearing age, their health status is not only related to the physical health of individuals but also related to the robust development of future generations. Much less than normal weight can lead to a decline in physical fitness and energy, while obesity is pertinent to a range of metabolic disorders, particularly hyperinsulinemia with insulin resistance and hyperandrogenemia. These factors may directly or indirectly be harmful to ovarian function, giving rise to a decline in female reproductive function [3]. However, in modern society, women of childbearing age usually face a lack of time and work pressure, which leads to many people's irregular exercise and eating habits, which affects their physical health.

Body Mass Index (BMI) are significant indicator to assess personal physical health, and the frequency of exercise and diet are important factors affecting these two indicators. Also, race, age, educational level, parity, and smoking status may be potential factors influencing BMI.

Studies have shown that there is a certain correlation between women's exercise frequency diet structure and BMI. Combined diet and exercise interventions brought about more weight loss than diet interventions alone [4]. Exercise can help burn calories, reduce fat accumulation, and improve the body's metabolic capacity, which can lower BMI and body fat content. Women who exercise moderately often tend to have a better BMI, while a high-carb or high-fat diet may lead to high body fat.

When analyzing female BMI, the existing literature often ignores the complex relationship between multiple variables such as ethnicity, age, education level, number of children born, smoking status, and activity frequency. This research gap leaves us with little understanding of how to effectively improve the health of women of a particular race. Therefore, exploring the correlation between them from multiple dimensions has an important promoting role in filling this academic gap. By revealing how these factors work together to influence BMI, the interaction of these factors can be better understood. The research could provide empirical support for future public health policies to target health improvements in women of different races.

2. Method

The data comes from the Kaggle website, which is collected by the University of Alabama at Birmingham, including demographic information, lifestyle factors, and dietary intake data of 504 reproductive-age women aged 19-50 living in Birmingham, Alabama. Demographic data includes age, race, level of education, parity, and BMI. Lifestyle data variables consist of physical activity levels (minutes per week) and current smoking status (yes/no). Dietary intake data provided information reflecting the average daily intake of calories over 12 months, as well as the percentage of calories from fat, protein, carbohydrates, and alcoholic beverages [5].

Underweight is defined as having a BMI of less than 18.5. A BMI between 25 and 30 is considered overweight, and over 30 is considered obese [6]. Education levels are divided into eight levels. No formal education, grades 1-6, grades 7-11, completed high school/general education development (GED), vocational/trade school, some college, completed college, some/completed Graduate. A high school/ GED degree or below is considered a lower degree. In the data set, there are no people with no formal education and grades 1-6.

Statistical analysis is performed using the statistical software SPSS. Two-sample t-test is applied to determine the significance of differences in various indicators between the two races, between smokers and non-smokers, and between the lower education groups and the higher education groups. The chi-square test is utilized to determine the significance of differences in the prevalence of smoking between Caucasian Americans and African Americans in addition to that between different education groups. Logistic regression is used to determine the association between BMI and other factors.

3. Results

Using descriptive statistics from the data set it can see that the majority of women are African American (64%), with 27 underweight (5.4%), 173 of normal weight (34.3%), 110 of overweight (21.8%), and

194 of obese (38.5%). About half (55%) have a high school degree or higher. 80 percent of the women engage in less than 150 minutes of moderate physical activity, and about a third smoke, the same proportion as women who have never given birth.

The data showed that race, smoking status, and education level all made differences in other factors in the data set.

The analysis results by ethnic groups in the survey sample are shown in Table 1. Compared with AA, the level of education, BMI, and intake of calories of CA is significantly lower (P< 0.05), while they took more moderate physical activity and had a higher intake of sugar in their diet. Through the Chi-square test, it is also found that more people smoked in CA (P<0.001).

Table 1. Independent sample test

	Race (Mean±SD)		$t(t^{'})$	p
	CA(n=179)	AA(n=325)		
BMI	26.744±7.983	29.938±8.613	-4.088	.000
Level of education	3.460±1.375	3.940±1.356	-3.719	.000
KCAL	2064.800±980.620	2613.030±1375.841	-5.181	.000
PCTSWEET	20.613±11.626	17.647±9.643	2.904	.004
confidence interval = 95% degree of freedom = 502				

The analysis results of the survey sample grouped by smoking or not are shown in Table 2. More smokers consume alcohol and sugar than non-smokers, but they have lower BMI and are more physically active. Besides their Level of education is lower.

Table 2. Independent sample test

	Current smoking status (Mean±SD)		$t(t^{'})$	p
	Yes(n=187)	No(n=317)		
Level of education	3.260±1.307	4.07±1.334	-6.692	.000
BMI	26.359±7.297	30.245±8.872	-5.322	.000
Moderate physical activity	168.790±444.458	88.680±226.359	2.295	.023
PCTSWEET	20.171±11.243	17.833±9.913	2.432	.015
PCTALCH	2.953±5.267	1.225±2.292	4.254	.000
confidence interval = 95% degree of freedom = 502				

The analysis results of the survey samples grouped by educational background are shown in Table 3. The number of children born, intake of calories, and dietary sugar are significantly lower in the highly-educated group than in the low-educated group (P< 0.05), while their dietary protein intake is higher. By Chi-square test, it is also found that people with lower education are more likely to smoke (P<0.001).

Table 3. Independent sample test

	Level of education (Mean±SD)		$t(t^{'})$	p
	>=4(n=222)	<4(n=282)		
Parity	0.900±1.082	1.400±1.166	-5.056	.000
KCAL	2286.110±1122.1	2522.403±1378.5	-2.070	.039
PCTSWEET	16.889±8.811	20.127±11.435	-3.590	.000
PCTPROT	13.040±3.238	12.227±2.949	2.942	.003

Table 3. (continued).

confidence interval = 95%
degree of freedom = 502

The results of linear regression are shown in Table 4. Linear regression can make predictions about one or more than one variable [X1, ..., Xn] based on the information that is known about another variable [Y] with the formula $Y = \beta_0 + \beta_1 X1 + ... \beta_n Xn$. In linear regression analysis, the ANOVA significance is less than 0.05, indicating that the regression equation is significant under the condition. The results showed that age, smoking status, and BMI have significant linear relationship ($P<0.01$). There is a slightly weaker significant linear relationship between birth times and BMI ($P<0.05$). Level of education and Moderate physical activity have a weakly significant linear relationship with BMI ($P<0.1$). In addition, the variance inflation factors of these variables are very small, that is, the correlation between independent variables is low, which is a relatively ideal situation.

Table 4. Coefficient of linear regression

	Standardization coefficient	P value
Age	.198	.000***
Level of education	-.088	.068*
Moderate physical activity	-.078	.073*
Parity	-.128	.011**
Current smoking status	.224	.000***
PCTSWEET	-.027	.537
t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01		

4. Discussion

4.1. Analysis of results

According to the results of the study, multiple factors are found to influence BMI and health behavior, which shows the consequence of the complex interaction of social and psychological factors.

Studies have shown significant differences between African American women (AA) and African American women (CC) in education level, body mass index, and energy intake. Lower levels of education can bring about ignorance of the proper amount of sugar in the diet. What is unexpected is that even if the CA education level is lower, they have a lower BMI. Studies have shown that education levels are often positively correlated with health behaviors. The likelihood of smoking, obesity and intemperance is slimmer for highly educated people [7]. The possibility may be that the intervention of exercise and smoking in the CA group is larger, so the low educational level does not affect BMI. The CA group exercised more, probably out of a need for weight management or improved health, and this increased health awareness could be associated with the spread of social support systems and health culture.

Smokers are found to have a lower BMI in the study, a result that may be related to the metabolic effects of smoking, which may increase the basal metabolic rate and thus affect body weight. At the same time, smoking may reduce appetite, causing smokers to crave certain foods less. This is consistent with existing research showing that current smokers stand less chance of being corpulent than never-smokers. Concerns about weight exert a major influence over decisions to commence and quit smoking among the younger generation, particularly women, and the anxiety of a gain in weight has been regarded as a cause of relapse among former smokers [8]. In addition, the relatively higher prevalence of smoking among people with lower education may be due to the poor consciousness of health risks, and thus choose to smoke as a stress release or social means.

As for the relationship between educational background and childbearing frequency, the childbearing frequency of higher educated women is significantly lower, which is closely related to modern society's emphasis on female education and the change of career development concept. The higher the education level, the more likely women are to delay childbearing choice. Refer to the conclusions of existing studies, for both genders, increased educational attainment is strongly associated with later childbearing, and also with a decline in fertility that had been completed or is nearing completion [9]. Hence, the relatively higher birth rates among the poorly educated population may be negatively influenced by traditional influences on attitudes toward fertility. According to the findings, health education for women with low education levels is extremely important. Designing intervention programs to raise their health awareness by providing basic nutrition, exercise, and education about the dangers of smoking may be effective in improving their overall health.

4.2. Suggestions

There are significant differences between groups of different ethnic and educational backgrounds, and individualized lifestyle intervention programs are recommended. For example, targeting African American groups could include more exercise programs in the community, promoting active lifestyles, and providing healthy eating options and education.

Given the weakly significant association between exercise frequency and BMI found in the study, it is proposed to encourage women to participate in more physical and social activities through a community revitalization program to increase sports participation in the group.

When assuming a linear relationship between BMI and other factors, several limitations must be considered. First, although weight classifications according to BMI are usually based on standard guidelines provided by the WHO, there is no scientific proof for these classifications whose ranges are rather arbitrary [10]. Second, BMI is not the best measure of obesity because it is wholly dependent on weight and height and does not accurately denote the distribution between lean mass and weight.

There may be limitations in sample selection in the study. Although gender and race are classified, the geographical area and socioeconomic background of the sample may not be adequately representative of the entire target population, which will have an adverse influence on the universality of the results.

Because this study relied on questionnaires to collect data, respondents may have biases in recalling diet and exercise patterns, resulting in reduced data accuracy, especially in measuring dietary intake and exercise frequency.

Many factors that influence BMI, such as mental state or family environment, may not be considered or controlled for in studies, leading to underestimates or miscalculations of the relationship between certain variables.

According to the above limitations, future studies can consider the diversification of a larger sample size, to more broadly cover the characteristics of people from different backgrounds, and improve the general applicability of research conclusions. If possible, longitudinal study designs are recommended to track changes in the same population to identify causal relationships and evaluate the effectiveness of intervention strategies. Meanwhile, it is recommended to gather more information, such as psychological health status, family support, and other factors, to build a more comprehensive model to better understand the complex interactions between different variables.

5. Conclusion

With the development of the economy, people pay much more attention to health issues and longevity. Through quantitative analysis, the findings reveal a compelling correlation between BMI and age, education, gender, smoking and exercise frequency, and primary element intake in women of two different ethnic groups. Along the way, multiple factors have been identified that may have an influence on BMI and health behavior, indicating the consequences of a complex interplay of social and psychological factors. These results not only help us better understand the status quo and hidden dangers

of women's health but also provide an important reference for the prevention and treatment of related diseases in the future.

Based on the findings, personalized lifestyle intervention programs could be introduced for different ethnic and educational backgrounds. Meanwhile, People should have access to more educational opportunities. The government should intervene to recommend active lifestyles and healthy dietary choices and publicize the dangers of smoking that need to be done in the long term. In addition, it is feasible to conduct the program of community activities to encourage women to participate in more physical and social sports activities. To increase the participation of the group, some novel exercise methods, such as live cardio on social media, are suggested to encourage sedentary people. Finally, it should be aware that this study also has some limitations, such as those in sample selection and reduced data accuracy.

Based on the existing research, future studies can consider the diversification of a larger sample size, to more widely cover the characteristics of people with different backgrounds and improve the universality of research conclusions. Future studies must delve deeper into the complexities of more factors such as mental health status and family support to gain a deeper understanding of the complex interactions between different variables. With more systematic and comprehensive research methods, more measures will be supplied for improving women's health, which will continuously prosper women's health management system, perfect women's quality of life, and facilitate the development of social health undertakings.

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