Research Article

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A cross-sectional study examined the relationship between body mass index and myopia in US population participants in the National Health and Nutrition Examination Surveys from 1999 to 2008.

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ABSTRACT

Context : This study looked into the relationship between myopia and body mass index (BMI) in the US.

Techniques Eight thousand participants from the National Health and Nutrition Examination Survey (NHANES) conducted between 1999 and 2008 were included in this cross-sectional investigation. Four groups based on BMI were identified: <18.5, <18.5 – 24.9, <25–29.9, and >29.9. For myopia A, B, and C, three diagnostic thresholds were applied: spherical equivalent ≤−0.5\−0.75\−1 diopters in the right eye. Smooth curve fitting and multivariate logistic regression analysis were used to assess the relationship between myopia and BMI.

Outcomes : There was a 39.4% incidence of myopia. Myopia and BMI were correlated; a 1% increase in myopia risk was linked to every 1 kg/m2 rise in BMI (OR, 1.01; 95% CI 1.01 1.02; p<0.05).After controlling for confounding variables, participants in myopia B who had a BMI between 25 and 29.9 and over 29.9 had a 14% and 25% increased risk of myopia, respectively (OR 1.14; 95% CI 1.01 1.29; p=0.037, OR 1.25; 95% CI 1.08 1.44; p=0.003), compared to the reference group (BMI 18.5–24.9). These results were comparable to those of myopic A (OR, 1.15; 95% CI 1.02 1.3; p=0.027, OR 1.19; 95% CI 1.03 1.37; p=0.018) and myopia C (OR 1.15; 95% CI 1.01 1.31; p=0.035, OR 1.18; 95% CI 1.01 1.37; p=0.032)). Furthermore, a linear connection (p for nonlinearity=0.767) was found between myopia and BMI.

Conclusion : In conclusion The three diagnostic thresholds for myopia showed a positive correlation with greater BMI. This suggests that there may be a connection between myopia and greater BMI in the US population, which calls for more research.

Keywords : BMI, Myopia, Linear, Cross-sectional study

INTRODUCTION

Context

When the ocular accommodation is loosened, light rays that enter the eye parallel to the optic axis and come into focus in front of the retina are referred to as myopia [1].

In the US, the prevalence of myopia rose from 25% in 1971–1972 to 41.6% in 1999–2004 [2]. According to two reports from China, the incidence of high myopia is 19.3% and 9.4%, respectively, and the prevalence of myopia among teenagers is 63.1% and 84.8%, respectively [3, 4]. The prediction states that in 2050, the prevalence of myopia would be 49.8%, while the prevalence of extreme myopia will be 9.8% [5]. Patients with myopia not only experience reduced vision, but they also face significantrisk of experiencing side effects that can significantly lower quality of life, such as myopic macular degeneration, retinal detachment, open-angle glaucoma, and cataracts [6, 7]. Myopia has emerged as a significant global public health issue. Myopia develops as a result of both environmental and genetic causes [8–10]. Myopia has been demonstrated to have a strong causal relationship with years of education [11], hours spent outside [12–14], and inflammation [15, 16].

Myopia may be linked to ten, late sleep [17], and high glycaemic load carbohydrate meals [18]. A high glycaemic load carbohydrate diet increases adipose tissue and increases the likelihood of becoming obese, according to the carbohydrate–insulin model of obesity [19–21]. Those who are obese typically have greater body mass indices (BMIs) than people who are not obese. Nonetheless, the findings of previous research on the relationship between myopia and BMI are inconsistent and primarily concerned Asian populations. Myopia has been connected to high BMI in certain studies [22, 23], low BMI in others [24], or neither in any of the studies [25, 26].

Therefore, in order to investigate the relationship between BMI and myopia in the US population, individuals who were enrolled in the National Health and Nutrition Examination Survey (NHANES) database between 1999 and 2008 were chosen.

Techniques

Participants and study design

The NHANES is a study program created to evaluate adults' and children's nutritional status and general health in the US.Every year, this poll is carried out using a sample of about 5,000 persons who are nationally representative. These people are dispersed throughout the nation's counties, with visits made to 15 of them each year. The Centers for Disease Control and Prevention's National Center for Health Statistics oversaw this investigation.

The National Center for Health Statistics' institutional review board accepted the study protocol, which complied with the Declaration of Helsinki's standards.

We acquired informed consent from each individual. The study protocol is described in further detail elsewhere [27].

This cross-sectional study used data from the NHANES database covering the years 1999 through 2008. Participants who said "don't know" when asked how much time they spent on everyday activities (n = 12) and those Having a daily non-physical activity period of less than five hours (n=44, as the accuracy of their answers was doubtful) were not included. Ten, all respondents from the 1999–2008 survey period were taken into account (n=56,505). Excluded from consideration were duplicate data (n = 6,262), missing data (n = 29,049) for any variable, and people who had undergone cataract surgery (n = 740), refractive surgery (n = 315), hyperopia (defined as spherical equivalent ≥0.5 diopters (D) (n = 4,198), were not aware that they had diabetes (n = 11), or were older than 25 (n = 7,930).

Ultimately, it was decided that 8,000 people would be good candidates for our study. Fig. 1 shows the inclusion and exclusion procedures.

Measurement and variables

Due to evidence of a strong correlation between the refractive errors in the right and left eyes, we exclusively used the right eye as the assessment eye [13]. The visual inspection was conducted by technicians who first got 8 weeks of training, followed by updates and corrective training as necessary. Using a Nidek Auto Refractor Model ARK-760 instrument, the objective refraction (sphere and cylinder) data were obtained by averaging three observations. The sphere plus half of the cylinder was used to calculate the spherical equivalent. Myopia was identified using three thresholds to assure trustworthy results, given the NHANES database does not account for cycloplegia in refractive tests. Myopia A was defined as spherical equivalent≤-0.5 D, myopia B as spherical equivalent≤−0.75 D, and myopia C as spherical equivalent≤−0.75 D.spherical equivalent ≤-1 D was defined as [1, 8, 28, 29].

Every examinee's body was measured by the skilled examiners at the mobile examination center. To lower the possibility of data input errors, standing height and weight data were electronically gathered from the measurement equipment. A specific video technique is available from the US Government Printing Office (https://wwwn.cdc.gov/nchs/nhanes/nhanes3/anthropometricvideos.aspx). Weight was divided by the square of height (BMI=kg/m2) to determine BMI, which was then separated into four groups: <18.5, 18.5–24.9, 25–29.9, and >29.9 kg/m2.

Through in-person interviews, information on age, sex (male and female), race (Mexican American, other Hispanic, non-Hispanic White, non-Hispanic Black, and other races), and diabetes was gathered. The borderline group for diabetes data was deemed to have no diabetes. Active living was measured using the NHANES PAQ.

metabolic equivalents were computed using the questionnaire and prior research as a guide [30]. Hitachi 717 and Hitachi 912 (Roche Diagnostics, 9115 Hague Road, Indianapolis, IN 46250) were used from 1999 to 2006 to measure high-density lipoprotein cholesterol (HDL-C), and from 2007 to 2008, a Roche Modular P chemical analyzer (Roche Diagnostics, 9115 Hague Road, Indianapolis, IN 46250) was used. Using the Beckman Synchron LX20 and Beckman UniCel® DxC800 Synchron, levels of triglycerides, total cholesterol, glucose, iron, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) were determined. Using latex-enhanced nephelometry, the levels of C-reactive protein (CRP) were measured.

Simple deletion was used to manage missing data when the percentage of missing values for the following variables were greater than 35%: iron (35.5%), triglycerides (35.5%), total cholesterol (35.5%), glucose (35.5%), AST (35.7%), ALT (35.7%), and physical activity (44.2%). cycler (35.5%). Additional Table 1 displays the frequencies and proportions of missing values in further detail. Table S1: Statistical techniques The mean±standard deviation (SD) was used to characterize the baseline data for each subject. The median (first and third quartiles) was used to characterize the measurement data that did not follow the normal distribution, and n(%) was used to characterize the count data. Physical activity was the subject of a mediation analysis that was corrected for diabetes mellitus, age, sex, race, ALT, AST, total cholesterol, triglycerides, HDL-C, glucose, iron, and CRP. The relationship between BMI and myopia was assessed using multivariate logistic regression analysis. Model 1 was corrected for diabetes mellitus, age, sex, physical activity, and race.Age, sex, physical activity level, race, ALT, AST, total cholesterol, triglycerides, and

HDL-C were all corrected for in Model 2. Age, sex, physical activity level, race, total cholesterol, triglycerides, HDL-C, glucose, iron, CRP, and diabetes mellitus were all taken into account while adjusting Model 3. The smooth curve fitting graph was created and modified in accordance with the Model 3 covariables. Because extreme numbers can have an impact, only the middle 95% of BMI data are displayed. The statistical software program R (http://www.R-project.org, Te R Foundation) and Free Statistics version 1.7 (http://www.clinicalscientists.cn/freestatistics/) were used for all analyses.

Outcomes

Out of 8,000 individuals with an average age of 16.9 years, 3149 individuals (39.4%) had a diagnosis of myopia B (sphericity equivalent of ≤−0.75 D). The baseline attributes are displayed in Table 1. The p-values for the physical activity-mediated effect on myopia A, B, and C were 0.2189, 0.184, and 0.1856 in that order. Table 2 displays the findings of the multivariate logistic regression analysis of myopia and BMI. For each of the three myopia diagnosis criteria, the trend was the same. Myopia and BMI were connected; a 1% increase in myopia risk was linked to every 1 kg/m2 rise in BMI (OR 1.01; 95% CI 1.01 1.02; p<0.05). Participants with a BMI of 25–29.9 and greater than 29.9 had a 14% and 25% increased risk of myopia, respectively, in myopia B (spherical equivalent≤−0.75 D), compared with the reference group (BMI 18.5–24.9) (OR 1.14; 95% CI 1.01 1.29; p=0.037, OR 1.25; 95% CI 1.08 1.44; p=0.003). was comparable to model 3's results for myopia C (spherical equivalent≤-1 D, OR 1.15; 95% CI 1.01 1.31; p=0.035, OR 1.18; 95% CI 1.01 1.37; p=0.032) and myopic A (spherical equivalent≤−0.5 D, OR 1.15; 95% CI 1.02 1.3; p=0.027, OR 1.19; 95% CI 1.03 1.37; p=0.018).A linear link between BMI and myopia B was demonstrated by smooth curve fitting (p for nonlinearity=0.767, Fig. 2).

DISCUSSION

Talk Our 8,000-person cross-sectional study found a linear connection between BMI and myopia (OR 1.01; 95% CI 1.01 1.02; p<0.05). The multifactorial analysis revealed that individuals with a BMI between 25 and 29.9 and higher than 29.9 had a 14% and 25% increased risk of myopia (spherical equivalent≤0.75 D), respectively (OR 1.14; 95% CI 1.01 1.29; p=0.037, OR 1.25; 95% CI 1.08 1.44; p= the diagnostic threshold was changed to 0.003). The trend did not change when the participants had a BMI of −0.5D (OR 1.15; 95% CI 1.02 1.3; p=0.027, OR 1.19; 95% CI 1.03 1.37; p=0.018) or −1 D (OR 1.15; 95% CI 1.01 1.31; p=0 0.035, OR 1.18; 95% CI 1.01 1.37; p=0.032).Asian children and a healthy BMI are the current focus of myopia and BMI research.teenagers. In a cross-sectional study, 1,359,153 Israeli teenagers between the ages of 16 and 19 who had medical exams prior to being conscripted into the military were included. The results revealed that the BMI for teenage myopia was a j-shaped pattern displayed as a bar chart, and that both a higher and lower BMI were linked to an increased risk of myopia [22]. Our analysis yielded linear findings, which are shown as smooth curve fitting. Lower BMI did not seem to be linked to myopia in the US population, but greater BMI was likewise associated with a higher odds ratio. In a similar vein, A Korean cross-sectional study conducted from 2016 to 2018 using data from the KNHANES VII database on 24,269 individuals aged 5 to 18 years. The study demonstrated a correlation between high myopia in girls and obesity in childhood and adolescence as well as between overweight and high myopia in children [23]. Table 2's results indicate that there is insufficient proof.to demonstrate the correlation between myopia and BMI, which contradicts our findings; the variation could be attributed to the various populations that were chosen. A study conducted on 6,855 participants aged 12 to 25 years, using data from the 2003–2008 NHANES database, revealed no correlation between BMI and myopia (R2=0, P=0.79) [26]. The following are a few potential differences that could have led to the various outcomes: First, physical activity was taken into account as one of the confounding factors when evaluating the connection between BMI and myopia using multivariate analysis; second, BMI was not only examined as a continuous variable but was also examined in teams. Different groups' OR came to different conclusions. Thirdly, the sample size (eight thousand) varied, and this variation might have been caused by the fact that the population from 1999 to 2008 was included. According to quartiles and logistic regression, there was no correlation between myopia and BMI in a research of 19-year-old male consignors in Seoul, Korea [31]. A greater BMI seems to favor a risk factor over a protective factor in our study. Variations in population selection could be the cause of the variations in outcomes.

There is a correlation between BMI and myopia that is influenced by lifestyle factors. One research, which examined children during a COVID-19-induced lockdown, discovered a link between a reduction in outdoor time and increased myopia [32].

Youngsters who play outside more often than their classmates could have lower BMIs [33]. This could be a plausible rationale for our linear outcomes. Physical activity was shown not to mediate the relationship between BMI and myopia after mediating role analysis. We took into account the possibility that it was a confounding factor influencing the outcomes by included it in the multivariate analysis.

There are several restrictions on this research. First, a causal link between BMI and myopia could not be established due to the cross-sectional nature of the study design. Furthermore, the prevalence of myopia increases when refractive error is measured in the absence of cycloplegia.

A Korean cross-sectional study conducted from 2016 to 2018 using data from the KNHANES VII database on 24,269 individuals aged 5 to 18 years. The study demonstrated a correlation between high myopia in girls and obesity in childhood and adolescence as well as between overweight and high myopia in children [23]. Table 2's results indicate that there is insufficient proof.

CONCLUSION

Using all three diagnostic thresholds, our study found a positive correlation between increased BMI and myopia. This suggests that there may be a connection between myopia and greater BMI in the US population, which calls for more research.

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