Associations of Smoking Behaviors and Body Mass Index Among American Participants of a Clinical Tobacco Cessation Program: A Pilot Study

Tobacco Use Insights
Volume 17: 1–7

DOI: 10.1177/1179173X241272359

Jihyun Jane Min[1], Bekir Kaplan[2], Alejandra Ellison-Barnes[3] and Panagis Galiatsatos[3]

[1]Johns Hopkins University, Krieger School of Arts and Sciences, Baltimore, MD, USA. [2]Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA. [3]Johns Hopkins University School of Medicine, Baltimore, MD, USA.

ABSTRACT

BACKGROUND: Tobacco usage and obesity remain critical public health issues in the United States. This study examined the relationship between smoking behaviors, specifically—cigarettes per day (CPD) and motivations to smoke—and body mass index (BMI). We hypothesized that motivations related to food or stress, as well as a higher CPD, will be positively associated with BMI.

METHODOLOGY: We analyzed the electronic medical records of 204 patients from the Johns Hopkins' Tobacco Treatment and Cancer Screening Clinic (TTCSC) between January and April 2022. Demographic information, smoking behavior, CPD, and motivations to smoke were recorded. Multiple linear regression analysis was performed.

RESULTS: We found no statistical significance between motivations to smoke, CPD, and BMI. However, the age at a patient's first visit to the TTCSC was negatively associated with BMI ($B = -0.152$, $P < 0.001$).

CONCLUSIONS: Smoking behaviors were not significantly related to BMI in our sample. It is advisable for clinicians working in tobacco cessation clinics to consider the BMI of individuals who present for cessation services, especially for younger individuals who smoke. They may be more likely to have an elevated BMI at presentation.

KEYWORDS: body mass index, smoking cessation, age, motivation to smoke, cigarettes per day

RECEIVED: April 16, 2024. **ACCEPTED:** July 12, 2024.

TYPE: Original Research Article

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Jihyun Jane Min, Johns Hopkins University, Krieger School of Arts and Sciences, 3400 North Charles Street, Baltimore, MD 21218, USA. Email: jmin17@jh.edu

Background

Obesity has been prevalent in the United States, where the rate of obesity was 41.9% for adults aged over 20 from 2017 to 2020.[1] Although the rate of tobacco use has declined within the past few decades, approximately 12% of American adults continue to smoke as of 2021.[2] Not only are these public health issues persistent, but they also impose significant health issues when combined. For instance, both tobacco usage and obesity put individuals at greater risk for stroke, diabetes, or heart disease, and current smokers with obesity are at a 3.5 to 5-fold greater risk for all-cause mortality than normal-weight, never-smokers.[3,4] Therefore, it is crucial to further examine the relationship between these two public health issues by analyzing how smoking behaviors are related to body mass index (BMI) for patients seeking tobacco cessation management.

Several past studies have investigated the association between the number of cigarettes (eg, cigarettes per day) and BMI. In longitudinal studies, the research compared the BMI among individuals who exhibited different frequencies of smoking and found that smoking was inversely associated with BMI.[5-7] Non-longitudinal studies with adult participants from the West Bank and China also showed the aforementioned relationship.[8] However, other research on European adults who smoke observed a positive association between the frequency of smoking and BMI or the risk of obesity.[9-12]

Individuals' self-reported motivations that trigger them to smoke may be related to BMI. One motivation is weight loss, where many individuals who smoke believe in the appetite-suppressing and metabolically enhancing effects of cigarettes and, thus, hope that these effects would assist them in losing weight.[13-16] Individuals who smoke act on this belief, ultimately experiencing a lower BMI.[17-21] On the other hand, individuals may combine smoking with eating because nicotine dependence has been related to experiencing higher food cravings, especially for foods with high fat and sugar content.[22] Along with food, stress is a highly-cited reason to smoke, where research has shown that more than 72% of individuals who smoke utilize smoking as a coping mechanism to deal with stress. The

association between stress as a motivation to smoke and BMI has inconsistent results, where several studies have found either a positive or negative association.[23-27]

There have been only two studies that are specifically targeted to explore how various motivations to smoke may be associated with BMI,[28,29] and they used relatively small sample sizes of 69[28] and 79 patients.[29] Our study will address these concerns using a relatively larger sample size (n = 204). It will also attempt to clarify the relationships between cigarettes per day (CPD) and motivation to smoke and how both, in turn, affect BMI. In addition, only one of these studies utilized a sample of patients seeking smoking cessation.[28] Therefore, it is vital to continue studying the effects of smoking on BMI for this patient population, as patients hoping to quit smoking are at a higher risk for weight gain and obesity than the general population of individuals who smoke.[30] Therefore, their information when first attempting to quit smoking can be vital for physicians to recognize when attempting to treat these patients.[4,31] It is hypothesized that individuals who smoke and cite food or stress as a motivation to smoke at their initial clinic visit for tobacco cessation management will have higher BMI.

Methods

Study participants

All study participants were patients from the Johns Hopkins' Tobacco Treatment and Cancer Screening Clinic (TTCSC). The electronic medical records (EMR) of 204 patients seen in the clinic from January 2022 to April 2022 were reviewed. Any patient of 18 years or older was eligible for review. We excluded patients who met the following criteria: pregnant, breastfeeding, or in the six-month postpartum period; being currently in receipt of other treatment for smoking cessation or weight control; being diagnosed with a current severe psychiatric disorder, eating disorder, or substance use disorder other than tobacco use disorder; having any health condition requiring a specialized diet or that affected eating (eg, uncontrolled diabetes); or taking medication that affects weight. This study was approved by the Institutional Review Board at the Johns Hopkins School of Medicine (IRB00282725). This was a retrospective chart review of patients enrolled in the Tobacco Treatment Clinic. The review of the clinical notes is performed to understand the clinical utility of the variables in regard to a patient's smoking phenotype. Such reviews are approved by the Institutional Review Board as a quality improvement project.

Data collection and study design

The initial clinic visit in the TTCSC involved answering a series of questions about tobacco dependence. These variables included the patient's age when they first started smoking, the number of cigarettes they smoked per day (CPD), and their motivations to smoke. Motivations or triggers were elicited using an open-ended question; patients were not provided with a list of possible responses. Demographic variables were captured by the EMR.

Our outcome of interest was BMI. To most accurately record a patient's BMI for their initial clinic visit, we utilized the BMI from the EMR on the date of their visit, if available. All patients had their weight captured on the Rice Lake 250 Bariatric Scale, asking for shoes to be removed and being in light clothing. Height was provided verbally by the patient. However, because most patients did not have a BMI recorded on the same day as their initial clinic visit, we allowed for recording a patient's BMI within three months before or after their initial clinic visit—a reasonable adjustment as most adults gain an average of one to two pounds each year.[28] Patients who did not have a recorded BMI within this timeframe were removed from the sample. A BMI of <25 was considered a normal weight, 25 to 29.9 was overweight, and ≥30 was considered obese.

Our predictors were the motivations to smoke and the number of CPD. Motivations to smoking were categorized into the following: stress, food, coffee, other, time of the day, first thing in the morning, location, social influence, boredom, driving, break at work, and alcohol. For our clinical approach, we do not assess the immediate motivation on any prior scale. Given our strategy is focused on implementation, thinking of small interventions at a time with immediate follow-up, we provide small goals, and if achieved in 4-week, we see this as ongoing motivation to smoking cessation as we wean the patients off of cigarettes and compliant with counseling with or without pharmacotherapy.

Covariates included sex, race, and age at the first visit to TTCSC.

Statistical analysis

Statistical analyses were performed using SPSS® for Windows®, version 21.0 (SPSS Inc, Chicago, IL, USA). Descriptive statistics (frequencies and percentages), Chi-Square to compare the BMI of the participants and multiple linear regression (MLR) analyses were conducted to assess potential associations between participants' BMI and smoking behaviors. The BMI of the participants had a normal distribution. We decided on the final MLR model by adding the variables that had less than 0.250 *P*-values in the Chi-Square analysis (Table 1), "age started smoking cigarettes," and sex (male/female) variables. The MLR analysis was employed to explore the continuous dependent variable, BMI, and dependent variables.[32] All statistical tests were two-sided ($\alpha = 0.05$).

Results

Baseline characteristics

As referenced in Table 2, among the 204 study participants, almost half were in the age range of 55-64 (44.1%), more than half were female (62.3%), and more than half were White (54.9%). Almost all (94.5%) were using cigarettes only (ie, a few

Table 1. Sociodemographic Characteristics of the Participants by BMI.

CHARACTERISTICS	GROUPS	BMI (KG/HEIGHT(M)^2)						*P*
		<25		25-29		≥30		
		N	%	N	%	N	%	
Age at first visit (Years)	18-44	7	31.8	5	22.7	10	45.5	0.215
	45-54	7	16.7	6	14.3	29	69.0	
	55-64	25	28.7	20	23.0	42	48.3	
	≥65	18	38.3	8	17.0	21	44.7	
Age started smoking (Years)	<15	23	28.7	14	17.5	43	53.8	0.743
	15-17	19	35.8	10	18.9	24	45.3	
	18-24	10	22.7	9	20.5	25	56.8	
	≥25	5	23.8	6	28.6	10	47.6	
Sex	Male	25	33.8	12	16.2	37	50.0	0.406
	Female	32	25.8	27	21.8	65	52.4	
Race	White	41	38.3	17	15.9	49	45.8	0.007
	Black	16	18.2	22	25.0	50	56.8	
Number of cigarettes per day	1-5	8	34.8	4	17.4	11	47.8	0.214
	6-10	10	19.2	11	21.2	31	59.6	
	11-20	20	25.6	19	24.4	39	50.0	
	>20	16	43.2	4	10.8	17	45.9	
Motivation - stress	No	23	35.9	8	12.5	33	51.6	0.125
	Yes	34	25.4	31	23.1	69	51.5	
Motivation - food	No	23	26.7	17	19.8	46	53.5	0.845
	Yes	34	30.4	22	19.6	56	50.0	
Motivation – Time of the day	No	39	25.3	33	21.4	82	53.2	0.114
	Yes	18	40.9	6	13.6	20	45.5	

utilized chewing tobacco or smokeless tobacco). Regarding their cigarette use frequency, more than half (55.4%) smoked less than 20 cigarettes (one pack) per day at the time they first visited the TTCSC. Lastly, 50.0% of the participants had a BMI of ≥30, which indicates obesity.

Motivations to smoke

Self-reported motivations to smoke are summarized in Table 3. The most common motivations reported were stress (67.2%), followed by food (56.9%) and coffee (32.4%).

Factors Related to BMI

Table 4 shows the multiple linear regression analysis that was performed to determine whether motivation to smoke and CPD was associated with a patient's BMI. Other variables, such as the patient's race, sex, age at their first clinic visit, and age at smoking initiation, were added as controls as we deemed them reasonable in influencing a patient's BMI. Results show that a patient's age at their first visit was negatively associated with BMI ($\beta = -0.122$, 95%, CI: -0.239, -0.006) after adjusting for sex, race, age at starting smoking, number of cigarettes per day, time of the day, and motivation. Every one-unit increase in age was associated with a 0.152-unit decrease in BMI. No statistically significant relationship was seen between motivations to smoke or CPD and BMI.

Discussion

The charts of 204 patients seen at the Johns Hopkins' TTCSC from January to April 2022 were reviewed to assess the relationship between their number of smoked CPD with BMI and

Table 2. Descriptive Statistics of all Variables in the Study.

VARIABLES	N	%
Age at first visit (Years)		
18-44	24	11.8
45-54	43	21.1
55-64	90	44.1
≥65	47	23.0
Sex		
Male	77	37.7
Female	127	62.3
Race		
White	112	54.9
Black	88	43.1
Other	4	2.0
Age at smoking initiation (Years)		
<15	81	39.7
15-17	56	27.5
18-24	46	22.5
≥25	21	10.3
Number of cigarettes (per day)		
1-5	23	11.8
6-10	53	27.2
11-20	82	42.1
>20	37	19.0
BMI		
<18	4	2.0
18-24.9	53	26.8
25-29·9	39	19.7
≥30	102	51.5
Total	204	100.0

Note. BMI: Body Mass Index.

Table 3. Motivation and influence on smoking (n = 204).

MOTIVATION	N	%[A]
Stress	137	67.2
Food	116	56.9
Coffee	66	32.4
Other	56	27.5
Time of the day	47	23.0
First thing in the morning	41	20.1
Location	41	20.1
Social influence	34	16.7
Bored	28	13.7
Driving	28	13.7
Break at work	20	9.8
Alcohol	17	8.3

Note. [a]Row percentage (1 person can mention more than one option).

their motivations to smoke with BMI. While we hypothesized that the motivators of food and stress, along with the number of CPD, would be positively associated with BMI, this observational cohort study did not show any significant relationship. However, we found that there was a negative association between the age of a patient at their first clinic visit and their BMI.

Although our study did not show statistical significance for the number of CPD and BMI, prior studies have observed an association. For instance, one study analyzing a sample of former individuals who smoke found that the number of CPD was not related to obesity and being overweight for women, but it did for men.[13] It is significant to note, however, that even though CPD may not be consistently correlated with BMI, it may have a strong association with fat accumulation. A study with Saudi Arabians who smoke found that waist circumference and body fat were positively associated with CPD,[33] while no statistical significance was shown with BMI.[34] Similarly, the CPD of Swiss individuals who smoke was related to fat accumulation and not BMI.[35] The mix of studies with varying results on the relationship between CPD and BMI also corroborates the potential bidirectional relationship between smoking and obesity. Cigarette smoking has also been shown to influence metabolism by elevating fatty acids and glycerol levels, which partially explains why quitting smoking can quickly have a positive impact on metabolism. Research by Pezzuto et al (2023)[36] supports this, showing that quitting smoking can lead to improvements in high-density lipoprotein cholesterol and total cholesterol levels. This evidence may also explain why our study did not find a significant link between actively smoking and a decrease in BMI.

Prior literature demonstrates that certain motivations to smoke and BMI are related, although it did not show statistical significance in our study. Numerous studies have reported a wide range of individuals who smoke—adolescents, female high schoolers, college students, general adult women, or those who binge eat—are motivated to smoke because they believe smoking will incline them to consume less food and stimulate their metabolism to burn calories faster.[17-21] Therefore, we hypothesized that those who, instead, report food as a motivation to smoke would have a higher BMI. However, due to the contrary results of our study against others in the past, future research may benefit from pursuing this question further, specifically among individuals who smoke and are seeking tobacco cessation management.

We also hypothesized that stress would be positively associated with BMI among individuals who smoke because of research that attests to this presumption. For instance, a paper by Kendzor et al[24] (2014) found that among individuals who smoke in a smoking cessation program, those who experienced

Table 4. Factors Affecting BMI of the Participants (Multiple Linear Regression).

CHARACTERISTICS	*B*	*B*	SE	95% CI	
Age at First Visit	−0·152***	0.122***	0.059	−0.239	−0.006
Female gender	0.059	1.005	1.243	−1.448	3.458
Race	0.100	1.437	1.117	−0.767	3.640
Age at smoking initiation	−0.006	−0.008	0.089	−0.183	0.67
Number of cigarettes per day	−0.008	−0.006	0.061	−0.127	0.114
Motivation – Time of the day	−0.112	−2.208	1.435	−5.040	0.624
Motivation – Stress	0.038	0.667	1.273	−1.845	3.179
Constant		35.130	4.753	25.753	44.508

B = unstandardized coefficient, *b* = standardized coefficient, SE = standard error, CI = confidence interval, ***$P < 0.001$.

more stress due to factors such as a lower income or living in a disadvantaged neighborhood requiring hypervigilance had higher BMI. Furthermore, reduced working hours have lowered BMI for French individuals who smoke, and the authors of this study postulate that it may be due to reduced stress.[25] However, once again, the research on this issue is mixed. Although people living in stressful neighborhoods are more likely to smoke, they tend to have a lower BMI[27] instead of a higher one, prior research has found.[24,25] Therefore, stress is not always associated with increased BMI among individuals who smoke and should be further investigated.

As mentioned, we only know of two comprehensive studies that have studied how various motivations to smoke are related to BMI. One of these is by Hovland and Ceballos (2007), whose study examined smoking cessation patients,[28] but a study by Ely et al[29] (2021) examined the same question by utilizing general individuals who smoke. Hovland and Ceballos (2007) observed that normal-weight individuals who smoke were more likely to smoke for tension reduction and the enjoyment of handling a cigarette, but overweight individuals who smoke were more motivated to smoke for stimulation. On the other hand, Ely's study found that individuals who smoke with higher BMI were less likely to say they smoke for stimulation and indulgence[29]—which is opposite to the results of Hovland and Ceballos' study (2007). The results of Hovland and Ceballos' study (2007) have greater applicability to ours as we both utilize individuals who smoke specifically seeking smoking cessation. However, Hovland and Ceballos (2007) collected already-existing participants in a smoking cessation study, meaning that many participants may have changed their motivations to smoke while receiving management. Our study uses information from people's first clinic visits for cessation management, meaning they have not yet been under the guidance of health care professionals in attempting to quit. Therefore, whether or not individuals who smoke have received ongoing support from clinicians to quit smoking could potentially influence the motivation of individuals who smoke and their BMI.

Another potential explanation for our study results would be that ours may have been impacted by the trend of unintentional weight loss, which is particularly common for older individuals.[37] In fact, unintentional weight loss occurs for 27% of those 65 years and older—a concern as weight loss is associated with increased risk for mortality, difficulty in performing daily functions, poorer quality of life, and hospital complications.[37,38] Considering BMI may rise further with the achievement of smoking cessation, clinicians should remain aware of patients' BMI and age at presentation to counsel on associated risks (eg, cardiovascular disease, diabetes). It is crucial to ensure that patients have proper access to resources for weight management to mitigate the potential for increased risk for chronic conditions associated with a high BMI. Future research should investigate whether smokers' age has an impact on the likelihood of weight loss or gain following cessation.

While not our primary research question, we did note a statistically significant relationship between increasing age at the initial visit to the TTCSC and lower BMI, suggesting younger individuals who smoke but are attempting to quit smoking may be more vulnerable to having a higher BMI compared to older individuals who smoke. These results may support the general trend of increasing obesity rates for younger adults, where Aggarwal et al (2023) found that the prevalence of obesity rose from 32.7% to 40.9% from 2009 to 2020.[39] The older patients within our study may have also developed chronic diseases that are associated with lower weights, such as chronic obstructive pulmonary disorder (COPD) and cancer.[37,38]

There are also several limitations of our study. The first is that despite our sample size of n = 204 being larger than those of prior research that investigated the relationship between the motivation to smoke and BMI, a larger sample size is likely needed in future studies to most accurately evaluate the association. Motivations were collected through open-ended responses, which led to high variability within responses since patients were not prompted with ideas for what responses to give, which may have resulted in not capturing the full range of each patient's motivations. Surveys utilizing already-validated

models from prior research might have yielded more standardized responses with less subjectivity on the part of the clinician or data collector.[40]

We were unable to account for education level or income, which are known to influence BMI.[41,42] Other factors influencing BMI that we did not consider for this analysis include alcohol consumption, psychiatric or other obesogenic medications, weight loss medication, or other lifestyle factors. We suggest studies to account for these limitations to investigate this research question further. We were also unable to use validated tools to evaluate the motivations to quit smoke among participants in our study. Therefore, it is suggested to consider conducting in-depth interviews or using specific sub-scale questions developed by West (2004) to explore a similar research question.[43]

Finally, this study was conducted in a single metropolitan area in the U.S. Hence, this study outcome would not be directly applied to other countries outside the U.S. due to differences in social and economic systems. Despite the limitation, our pilot study would allow us to initiate the feasibility and effectiveness of the interventions by contributing to scientific knowledge with updated findings.

Conclusions

Our research emphasizes the significance of taking into account several factors, including weight, when managing smoking cessation. Our study finding indicates that individuals who are concentrating on losing weight may face extra obstacles in quitting smoking because of worries about gaining weight. As a result, health care providers should be aware of these influences when guiding patients on strategies to stop smoking (eg, nicotine replacement therapy and avoiding triggers/stresses). Moreover, providing behavioral interventions that tackle both smoking cessation and weight control concurrently may be a viable option in the medical field. These interventions could assist individuals in overcoming obstacles to quitting smoking while still pursuing their weight loss objectives.

Author contributions

The authors confirm contribution to the paper as follows: study conception and design: J.J.M., P.G.; data collection: P.G., A.E.B., J.J.M.; access and verification of data: B.K., P.G., J.J.M.; analysis and interpretation of results: B.K., J.J.M., A.E.B.; draft manuscript preparation: J.J.M., B.K., A.E.B, P.G. All authors had full access to all the data utilized in this study and accepted responsibility for the final version of the manuscript to be submitted for publication.

Ethical Statement

Ethical Approval

This study was approved by the Institutional Review Board at the Johns Hopkins School of Medicine (IRB00282725). The need for informed consent was waived by the IRB.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

REFERENCES

1. Obesity and overweight. Available from: https://www.cdc.gov/nchs/fastats/obesity-overweight.htm
2. *Current Cigarette Smoking Among Adults in the United States*. 2023. Atlanta: Centers for Disease Control and Prevention; Available from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm
3. Centers for Disease Control and Prevention. Health Effects. 2022. Available from: https://www.cdc.gov/basic_information/health_effects/index.htm
4. Freedman DM, Sigurdson AJ, Rajaraman P, Doody MM, Linet MS, Ron E. The mortality risk of smoking and obesity combined. *Am J Prev Med*. 2006;31(5):355-362.
5. Jacobs M. Adolescent smoking: the relationship between cigarette consumption and BMI. *Addict Behav Rep*. 2019;9:100153.
6. Jong-Hyuck K, Wi-Young S. Association of smoking frequency and cigarette consumption with obesity in Korean adolescents. *Bratisl Lek Listy*. 2012;113(10):599-603.
7. Fidler JA, West R, Van Jaarsveld CHM, Jarvis MJ, Wardle J. Does smoking in adolescence affect body mass index, waist or height? Findings from a longitudinal study. *Addict Abingdon Engl*. 2007;102(9):1493-1501.
8. Mohammed Ali M, Helou M, Al-Sayed Ahmad M, Al Ali R, Damiri B. Risk of tobacco smoking and consumption of energy drinks on obesity and central obesity among male university students. *Cureus*. 2022;14(2):e21842.
9. Dare S, Mackay DF, Pell JP. Relationship between smoking and obesity: a cross-sectional study of 499,504 middle-aged adults in the UK general population. *PLoS One*. 2015;10(4):e0123579.
10. Wills AG, Hopfer C. Phenotypic and genetic relationship between BMI and cigarette smoking in a sample of UK adults. *Addict Behav*. 2019;89:98-103.
11. Carreras-Torres R, Johansson M, Haycock PC, et al. Role of obesity in smoking behaviour: mendelian randomisation study in UK Biobank. *BMJ*. 2018;361:k1767.
12. Chiolero A, Jacot-Sadowski I, Faeh D, Paccaud F, Cornuz J. Association of cigarettes smoked daily with obesity in a general adult population. *Obes Silver Spring Md*. 2007;15(5):1311-1318.
13. John U, Hanke M, Rumpf HJ, Thyrian JR. Smoking status, cigarettes per day, and their relationship to overweight and obesity among former and current smokers in a national adult general population sample. *Int J Obes*. 2005;29(10):1289-1294.
14. Sneve M, Jorde R. Cross-sectional study on the relationship between body mass index and smoking, and longitudinal changes in body mass index in relation to change in smoking status: the Tromso Study. *Scand J Publ Health*. 2008;36(4):397-407.
15. Jitnarin N, Kosulwat V, Rojroongwasinkul N, Boonpraderm A, Haddock CK, Poston WSC. The relationship between smoking, body weight, body mass index, and dietary intake among Thai adults: results of the national Thai Food Consumption Survey. *Asia Pac J Publ Health*. 2014;26(5):481-493.
16. Wehby GL, Courtemanche CJ. The heterogeneity of the cigarette price effect on body mass index. *J Health Econ*. 2012;31(5):719-729.
17. Harakeh Z, Engels RCME, Monshouwer K, Hanssen PF. Adolescent's weight concerns and the onset of smoking. *Subst Use Misuse*. 2010;45(12):1847-1861.
18. Copeland AL, Spears CA, Baillie LE, McVay MA. Fear of fatness and drive for thinness in predicting smoking status in college women. *Addict Behav*. 2016;54:1-6.
19. Pomerleau CS, Zucker AN, Stewart AJ. Characterizing concerns about post-cessation weight gain: results from a national survey of women smokers. *Nicotine Tob Res*. 2001;3(1):51-60.
20. Fulkerson JA, French SA. Cigarette smoking for weight loss or control among adolescents: gender and racial/ethnic differences. *J Adolesc Health*. 2003;32(4):306-313.
21. White MA, Peters EN, Toll BA. Effect of binge eating on treatment outcomes for smoking cessation. *Nicotine Tob Res*. 2010;12(11):1172-1175.
22. Chao AM, White MA, Grilo CM, Sinha R. Examining the effects of cigarette smoking on food cravings and intake, depressive symptoms, and stress. *Eat Behav*. 2017;24:61-65.
23. Croghan IT, Bronars C, Patten CA et al. Is smoking related to body image satisfaction, stress, and self-esteem in young adults? *Am J Health Behav*. 2006;30(3):322-333.
24. Kendzor DE, Businelle MS, Cofta-Woerpel LM, et al. Mechanisms linking socioeconomic disadvantage and BMI in smokers. *Am J Health Behav*. 2013;37(5):587-598.
25. Berniell I, Bietenbeck J. The effect of working hours on health. *Econ Hum Biol*. 2020;39:100901.
26. Fobian AD, Schiavon S, Elliott L, Stager L, Cropsey KL. Body mass index changes associated with smoking are moderated by race and depression. *J Health Care Poor Underserved*. 2020;31(3):1115-1123.
27. Chao AM, Wadden TA, Ashare RL, Loughead J, Schmidt HD. Tobacco smoking, eating behaviors, and body weight: a review. *Curr Addict Rep*. 2019;6:191-199.

28. Hovland J, Ceballos NA. Are smokers' reasons for smoking related to their body mass indices? *Subst Use Misuse*. 2007;42(8):1337-1344.
29. Ely AV, Keyser H, Spilka N, Franklin TR, Wetherill RR, Audrain-McGovern J. An exploration of associations between smoking motives and behavior as a function of body mass index. *Drug Alcohol Depend Rep*. 2021;1:100008.
30. Castro MRP, Matsuo T, Nunes SOV. Características clínicas e qualidade de vida de fumantes em um centro de referência de abordagem e tratamento do tabagismo. *J Bras Pneumol*. 2010;36(1):67-74.
31. LaRowe TL, Piper ME, Schlam TR, Fiore MC, Baker TB. Obesity and smoking: comparing cessation treatment seekers with the general smoking population. *Obes Silver Spring Md*. 2009;17(6):1301-1305.
32. Pallant J. *SPSS: Survival Manual*. 3rd ed. Crows Nest: Allen & Unwin.
33. Ginawi IA, Bashir AI, Alreshidi YQ, et al. Association between obesity and cigarette smoking: a community-based study. *J Endocrinol Metab*. 2016;6(5): 149-153.
34. Meule A, Reichenberger J, Blechert J. Smoking, stress eating, and body weight: the moderating role of perceived stress. *Subst Use Misuse*. 2018;53(13): 2152-2156.
35. Clair C, Chiolero A, Faeh D, et al. Dose-dependent positive association between cigarette smoking, abdominal obesity and body fat: cross-sectional data from a population-based survey. *BMC Publ Health*. 2011;11:23.
36. Pezzuto A, Ricci A, D'Ascanio M, et al. Short-term benefits of smoking cessation improve respiratory function and metabolism in smokers. *Int J Chronic Obstr Pulm Dis*. 2023;18:2861-2868.
37. Muers MF, Green JH. Weight loss in chronic obstructive pulmonary disease. *Eur Respir J*. 1993;6(5):729-734.
38. Nicholson BD, Thompson MJ, Hobbs FDR, et al. Measured weight loss as a precursor to cancer diagnosis: retrospective cohort analysis of 43 302 primary care patients. *J Cachexia Sarcopenia Muscle*. 2022;13(5):2492-2503.
39. Aggarwal R, Yeh RW, Joynt Maddox KE, Wadhera RK. Cardiovascular risk factor prevalence, treatment, and control in US adults aged 20 to 44 Years, 2009 to march 2020. *JAMA*. 2023;329(11):899-909.
40. Jones TL, Baxter Ma. J, Khanduja V. A quick guide to survey research. *Ann R Coll Surg Engl*. 2013;95(1):5-7.
41. Benson R, von Hippel PT, Lynch JL. Does more education cause lower BMI, or do lower-BMI individuals become more educated? Evidence from the National Longitudinal Survey of Youth 1979. *Soc Sci Med*. 1982;211:370-377.
42. Kim TJ, von dem Knesebeck O. Von Dem Knesebeck O. Income and obesity: what is the direction of the relationship? A systematic review and meta-analysis. *BMJ Open*. 2018;8(1):e019862.
43. West R. Assessment of dependence and motivation to stop smoking. *BMJ*. 2004; 328(7435):338-339.