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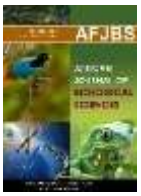

Overweight/Obesity and Dietary Habits Among Adults in a Moroccan Population

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Abstract

Introduction: The increasing prevalence of overweight and obesity among adult populations is a major public health. Changes in dietary behavior remain among the most significant risk factor. our objective was to investigate the association between dietary habits, lifestyle, and medical factors with obesity in adults.

Method: our study was conducted with 731 adult populations, selected through a stratified random sampling method. Data collection was performed using a questionnaire that included sociodemographic information, lifestyle-related factors, medical history and Dietary intake.

Results: the obesity increases with age in both sexes, with a higher prevalence in females ($p<0.0001$). The prevalence of obesity among individuals with diabetes and hypertension is very high in both sexes. We showed that the risk of obesity is very high among adults who consumefruits less than three times a week ($p=0.03$; OR=2.004) and red meats more than four times a week ($p=0.006$; OR=1.57), sweeties ($p=0.018$; OR=1.50), and fast food ($p<0.0001$; OR=3.34).

Conclusion: we recommend the implementation of awareness programs to prevent overweight/obesity and its associated diseases. These programs can include nutritional education and promotion of adopting a healthy diet.

Keywords: Overweight /Obesity - Eating habits – Association -Adult - Morocco

Introduction

Nutrition plays a crucial role in maintaining health and preventing chronic diseases by supporting the body's coordinated development and vitality. In addition to providing the body with the nutrition and energy it needs to function, a varied and balanced diet also works as a preventative and therapeutic measure, lowering the risk of chronic diseases including cancer, diabetes, obesity, and cardiovascular diseases. Because it affects long-term health outcomes, early life nutrition is especially important. Inadequate nutrition at this time increases the risk of chronic diseases in adulthood. Therefore, adopting a healthy and varied diet, such as the Mediterranean diet rich in nutrients and antioxidants, can positively influence overall well-being, longevity, and disease prevention (Lessem And Trapp, 2022; Sievenpiper et al., 2019).

Morocco, in line with various developing countries, is experiencing a significant shift in demographics, epidemiology, and societal norms. This transition is marked by a rise in noncommunicable diseases (NCDs), attributed to dietary imbalances such as increased consumption of fatty products, red meats, and sweets, alongside inadequate intake of fruits and vegetables. Studies indicate that adherence to the Mediterranean diet is suboptimal in Moroccan populations, with low compliance observed for key components like olive oil, fruits, and vegetables. Furthermore, the nutrition transition in Morocco is linked to changing eating habits, sedentary lifestyles, all contributing to the emergence of health issues like obesity and chronic diseases (Kaoutar et al. 2022; El Rhazi et al. 2012; Mohtadi et al. 2020).

The prevalence of obesity is a significant public health concern globally, with a notable increase observed over the years. Data from various studies indicate a rise in obesity rates among adults, with global figures nearly doubling between 1980 and 2014. And similar trends are observed in Morocco. Specifically, from 2000 to 2018, obesity rates in Morocco rose from 13.6% to 20%, with half of the adult population being overweight (El Rhazi et al., 2011; Ministère de la Santé-Steps, 2017; Tazi et al., 2003). The alarming increase in overweight and obesity rates among adults worldwide is driven by various factors, such as dietary habits, lifestyle choices, tobacco and alcohol use, and sedentary behaviors (El Rhazi et al. 2011). Research indicates that unhealthy eating habits, including poor diet, consumption of sugar-sweetened beverages. Younger individuals, women, and those already obese are more likely to engage in these behaviors. Lifestyle factors, including physical activity, sleep patterns, and alcohol consumption, are crucial in obesity development. Certain behaviors, such as regular exercise and moderate alcohol intake, are linked to a lower risk of obesity (Després et al. 2000; Mouzouni et al. 2022; Barich et al. 2018).The objective of our study

is to investigate the relationship between obesity and dietary practices, lifestyle factors and medical histories in representative adult population in Casablanca.

Populations and Methods

2.1. Design

A cross-sectional study was carried out to investigate the correlation between overweight/obesity and dietary patterns among the adult population in different districts of Casablanca city, using a cluster sampling method. The sampling strategy selected for this survey adheres to a simplified and three-tiered stratified system. Initially, the primary level consists of sampling units established by clusters, from which 80 clusters were chosen. The units at the secondary stage were households; within each cluster selected at the primary level, 10 households were selected. At the ultimate level, the tertiary tier, within each chosen household, a sole adult (male or female) was identified as a participant in this research (Figure 1).

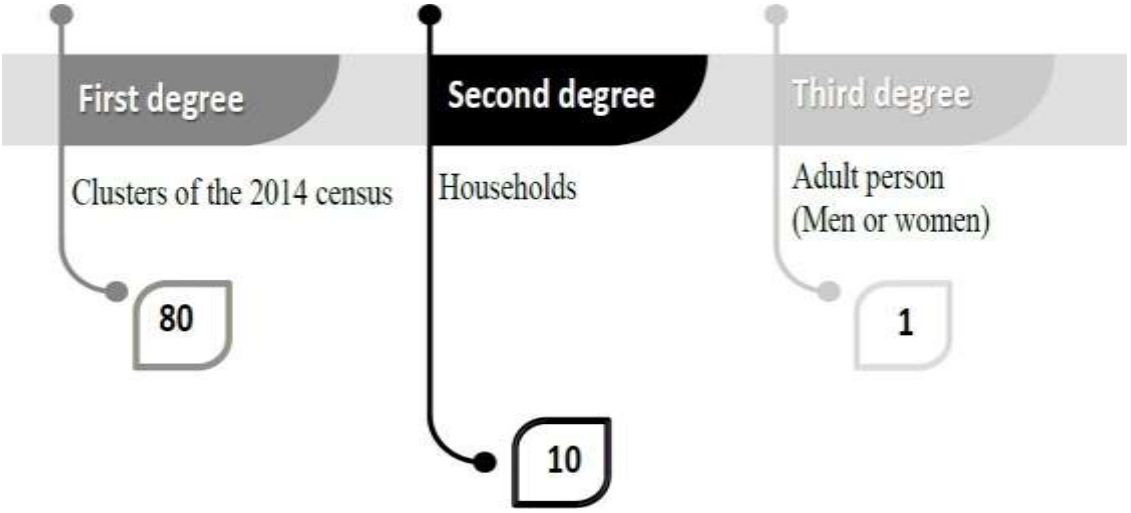

Figure 1: the sample approach.

2.2. Study participants

The study sample consisted of adult individuals, both men and women aged 18 years and above, representing various districts of the city of Casablanca. Pregnant or breastfeeding women, as well as individuals with physical or mental limitations, were considered ineligible. Before answering the questionnaire, all participants provided their consent. This study was conducted in accordance with the principles outlined in the Helsinki Declaration and approved by the Biomedical Research Ethics Committee of Casablanca. Additionally, we obtained a consent statement from all participants.

2.3. Data Collection

The data were collected using a questionnaire containing sociodemographic characteristics such as age, gender…, as well as medical history to establish the prevalence of chronic diseases among the participants, notably diabetes and hypertension. Participants were divided into different age groups (under 20 years old, 20-29 years old, 30-39 years old, 40-49 years old, 50-59 years old, and over 60 years old).

2.4. Anthropometric measurements

Surveys were designed to provide information on the weight classification of each individual. The prevalence of overweight in the population of the city of Casablanca was evaluated based on gender and age by calculating the Body Mass Index (BMI). Participants were classified into two categories: "Non-obese" and "Overweight/Obese", according to the criteria of the World Health Organization (WHO), with a BMI ranging from 25 to 29.9 kg/m² for overweight individuals, while obesity was defined as a BMI of 30 kg/m² or higher.

2.5. Evaluation of Dietary Habits

To assess the dietary habits of overweight/obese individuals compared to non-obese ones, a food frequency questionnaire was used, including the most consumed foods in Morocco by analyzing the frequency of consumption of specific foods, including vegetables, fruits, meats, dairy products, sweet products, and fast-food items. This questionnaire also allowed for gathering detailed information on the eating behavior of obese/overweight individuals towards these food groups.

2.6. Statistical Analysis

The statistical analyses were conducted using the SPSS statistical software. Frequencies (%) were calculated for qualitative variables, and for quantitative variables, medians or means with standard deviations (SD) were computed. Categorical variables were tested using the Chi-square test. Differences between groups were compared using the student’s t-test. The analysis of the

association between dietary habits and certain factors was performed using multivariate logistic regression. Odds ratios were estimated, with 95% confidence intervals (95% CI) and a significance level of 5% ($P \leq 0.05$).

Results

Our sample consisted of 731 individuals from the seven prefectures of Casablanca, after excluding those who refused to participate, were absent, or had missing data (Figure 2).

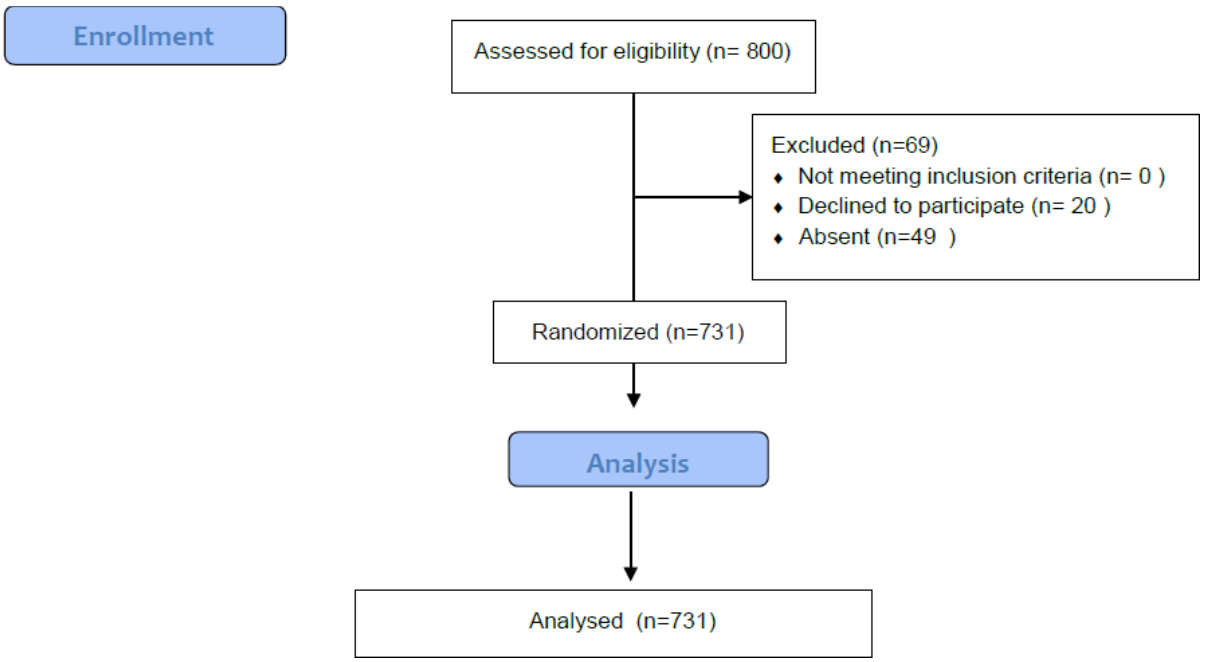

Figure 2: Flowchart of the study

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The table 1 presents an overview of obesity/overweight prevalence across different age groups in a sample of 731 individuals, and among sex (women (n=352) and men (n=379)). We reveal a notable increase in overweight/obese individuals with age in both genders. Women consistently exhibit a higher percentages of overweight/obese individuals compared to men within each age category.

Table 1: Overweight/Obesity Based on age and sex.

	women (n=352)			**men (n=379)**			**Total ((n=731)**		
Age group	**Non-obese**	**Overweight/ obese**	**P value**	**Non-obese**	**Overweight/ obese**	**P value**	**Non-obese**	**Overweight/ obese**	**P value**
<20	17(13 .9%)	3(1.3%)	<0.0001	37(15.9%)	4(2.7%)	<0.0001	54(15.2%)	7(1.9%)	<0.0001
20-29	48(39.3%)	33(14.3%)		82(35.2%)	24(16.4%)		130(36.6%)	57(15.2%)	
30-39	17(13.9%)	43(18.7%)		43(18.5%)	39(26.7%)		60(16.9%)	82(21.8%)	
40-49	19(15.6%)	68(29.6%)		28(12%)	23(15.8%)		47(13.2%)	91(24.2%)	
50-59	10(8.2%)	51(22.2%)		24(10.3%)	34(23.3%)		34(9.6%)	85(22.6%)	
>60	11(9%)	32(13.9%)		19(8.2%)	22(15.1%)		30(8.5%)	54(14.4%)	

Among the respondents, 15.7% reported having chronic diseases such as high blood pressure (HTA) and/or diabetes. The prevalence of overweight/obesity among diabetics and hypertensive

individuals is very high in both sexes, reaching 83.3% and 77.1% respectively (p<0.0001 for both). The rates of obesity among diabetic and hypertensive women are 88.9% and 80.8% respectively (p = 0.002, p = 0.011). Whereas, for diabetic and hypertensive men, the obesity rate is 66.7% for each (p= 0.039, p= 0.011). Regarding lifestyle among men, 24.4% of current smokers, 44.4% of former smokers, and 20.9% of alcohol consumers are overweight or obese (p=0.0001; p=0.015). However, we did not find a statistically significant difference among women concerning tobacco and/or alcohol consumption (Table 2).

Table 2: Overweight/Obesity and Chronic Diseases and lifestyle parameters

	Women(n=352)			**Men (n=379)**			**Total (n=731)**		
	Non obese	**Obese**	p value	**Non obese**	**Obese**	p value	**Non obese**	**Obese**	p value
Diabetes	11.10%	88.9%	**0.002**	33.3%	66.7%	**0.039**	16.7%	83.3%	**<0.0001**
HTA	19.20%	80.80%	**0.011**	33.30%	66.7%	**0.011**	22.9%%	77.1%	**<0.0001**
Smokers	50%	50%	**0.118**	75.6	24.4%	**0.0001**	73.3	26.7%	**<0.0001**
Ex-smokers	58.3%	41.7%		55.6%	44.4%		56.1%	43.9%	
Alcohol consumption	50%	50%	**0.57**	79.1%	20.9%	**0.015**	75.5%	24.5%	**<0.0001**

HTA: high blood pressure

Taking into account the frequency of consumption per week, our study revealed differences in eating behaviors between non-obese and overweight/obese groups based on gender. Non obese individuals showed a higher frequency of consumption of vegetables (≥4 times/week, 50.4%), or the obese showed a higher frequency of consumption of legumes (≥4 times/week, 53.7%), meats (≥4 times/week, 61.9%), sweet products (≥4 times/week, 55.5%), (*p* value <0.05). Additionally, the consumption of fast food was significantly higher among obese/overweight individuals, whether they were men or women (Table 3).

Table 3: Overweight/Obesity based on dietary habits by gender.

Type of food/ restaurants	Frequency	Women(n=352)		Men (n=379)		Total (n=731)	
		Non-obese	Obese	Non obese	Obese	Non obese	Obese
Starchy foods	<3 times/week	66.7	33.3	-	-	66.7	33.3
	≥4 times/week	35	65	37.3	62.7	50.6	49.4
Vegetable	<3 times/week	-	-	-	100	-	100
	≥4 times/week	35.5	64.5	37.9	62.1	50.4*	49.6*
Legumes	<3 times/week	32.6	67.4	40.3	59.7	53.7*	46.3*
	≥4 times/week	39.9	60.1	34.5	65.5	46.3*	53.7*
Fruits	<3 times/week	44	56	29.6	70.4	42.3	57.7
	≥4 times/week	34.6	65.4	38.3	61.7	51.3	48.7
Meats	<3 times/week	33.1	66.9	40.5	59.5	54.4*	45.6*
	≥4 times/week	46.3	53.7	30.7	69.3	38.1*	61.9*
Chicken	<3 times/week	34	66	44.4	55.6	56.1	43.9
	≥4 times/week	35.4	64.6	36.1	63.9	49.5	50.5
Fish	< 3 times/week	34.5	65.5	38.3	61.7	52.4	47.6
	≥4 times/week	39	61	36	64	45.5	54.5
Dairy products	<3 times/week	27.3	72.7	45.5	54.5	61	39
	≥4 times/week	36.6	63.4	36.9	63.1	49.4	50.6
Confectionery	< 3 times/week	23.9*	76.1*	42.7	57.3	58.9*	41.1*
	≥4 times/week	44*	56*	34.2	65.8	44.5*	55.5*
Fast food	Yes	52.4*	47.6*	278*	72.2*	34.3*	65.7*

* P value<0.05

Our results showed that the risk of overweight/obesity is very high among adults: who consume fruits less than 3 times a week (p=0.03; OR=2.004 [1.07; 3.752]) and who have a dietary intake of red meat more than 4 times a week (p=0.006; OR=1.57[0.391;0.855]), confectionery products (p=0.018; OR=1.50[0.474;0.934]), and fast food (p<0.0001; OR=3.34[2.397;4.68]). However, we did not find a statistically significant difference for other included products, notably starches, legumes, chicken, fish, and dairy products (Table 4).

Table 4: Association between overweight/obesity and dietary intake

		***P* value**	**OR**	**IC 95%**	
Starchy	<3 times/week	.571	2.067	.167	25.511
	≥ 4 times/week	.	.	.	.
Vegetables	<3 times/week	.208	.808	.580	1.126
	≥ 4 times/week	.	.	.	.
Fruits	<3 times/week	**.030**	2.004	1.070	3.752
	≥ 4 times/week	.	.	.	.
Meat	<3 times/week			.391	.855
	≥ 4 times/week	**.006**	1.578	.	.
Chicken	<3 times/week	.684	.906	.561	1.461
	≥ 4 times/week	.	.	.	.
Fish	<3 times/week	.500	.882	.611	1.271
	≥ 4 times/week	.	.	.	.
Dairy products	<3 times/week	.717	1.106	.641	1.908
	≥ 4 times/week	.	.	.	.
Sweeties	<3 times/week				
	≥ 4 times/week	**.018**	**1.503**	.474	.934
Fast food	Yes	**.000**	**3.349**	2.397	4.680
	No	.	.	.	.

Discussion

The global prevalence of overweight and obesity has doubled since 1980, with nearly one-third of the world's population now considered overweight or obese (Kinnunen et al. 2021; Mohajan et Mohajan 2023). Addressing this public health issue requires identifying risk factors for obesity to implement effective preventive measures. Unhealthy eating habits are among the factors that can have adverse effects on weight status (Sogari et al., 2018). A sedentary lifestyle coupled with the consumption of high-calorie foods is the leading cause of the increasing prevalence of obesity (Agrawal et al., 2013). Excessive consumption of ultra-processed products is directly linked to increased fat and sugar levels in the body, leading to nutritional imbalances and an uncontrollable risk of weight gain (Passos et al., 2020). Developing countries face a high risk of obesity due to energy-dense food consumption (unhealthy eating habits), sedentary lifestyles, lack of healthcare services, and financial support (Després et al., 2000).

In this context, we conducted this study to analyze the association between dietary habits and overweight/obesity among adults in Casablanca. Our results showed a positive association between certain dietary habits that are not in line with recommendations and the occurrence of overweight/obesity.

Regarding the prevalence of overweight/obesity concerning age and gender, our results align with most studies. Obesity prevalence increases with age and is higher in women than in men across various regions including Morocco (El Rhazi et al. 2011; Barich et al. 2018), Tunisia, Nepal, and Europe. In Tunisia, the HSHS4 study found high prevalence rates of obesity (28.11%) and overweight (36.18%) among adults, particularly affecting women and older adults (Khelil et al. 2022)**.** Similarly, the prevalence of overweight and obesity in Nepal, significantly increased among women aged 20 to 49 between 2006 and 2016 (Khanal, 2022). Moreover, Adilson Marques' study regarding prevalence in 20 European countries in 2014 showed significantly higher prevalence of overweight (42.4%) and obesity (20.9%) among older individuals than among middle-aged and younger adults, with a male predominance (men (44.7%) compared to women (30.5%)) (Marques et al., 2018). These results highlight the need for targeted interventions and awareness campaigns to address the increasing prevalence of obesity among women, especially those of childbearing age.

Our study showed that obesity rates are particularly high among individuals with diabetes and high blood pressure, emphasizing the complex links between these comorbidities and overweight/obesity. The obesity rates among diabetic and hypertensive women are 88.9% and 80.8%, respectively ($p = 0.002$, $p = 0.011$). Whereas for diabetic and hypertensive men, the obesity rate is 66.7% for each ($p = 0.039$, $p = 0.011$). Our results were consistent with other studies that have shown that obesity is positively associated with the risk of diabetes (Saxton et al., 2019). Obesity is also positively associated with high blood pressure (Bovet et al., 2002). Central obesity, in particular, is associated with an increased risk of undiagnosed diabetes and high blood pressure (Appel et al. 2004). These results underscore the importance of regular medical examinations to assess the risk of non-communicable diseases, such as diabetes and high blood pressure, in overweight or obese individuals.

The studies collectively emphasize various factors that contribute to this correlation, including obesity phenotypes, environmental exposures, and the age of obesity onset. For instance, a study Sheng et al. found that central obesity and sex differences significantly influence hypertension progression among middle-aged and older Chinese adults, suggesting tailored interventions for different obesity phenotypes (Sheng et al., 2023). Chen et al. explored various obesity patterns in US males and found that abdominal and compound obesity significantly raise hypertension risk

(Chen et al., 2023). Another study indicated that waist circumference is a crucial measure for assessing hypertension risk, especially in women who are more prone to abdominal weight gain (Çolak And Melihamervehız, 2022). These findings underscore the complex interplay between obesity and hypertension and the need for targeted prevention strategies.

Regarding lifestyle, our study showed that among men, 24.4% of current smokers, 44.4% of ex-smokers, and 20.9% of alcohol consumers are overweight or obese ($p = 0.0001$; $p = 0.015$). However, we did not find a statistically significant difference in women concerning tobacco and/or alcohol consumption. In the literature, the prevalence of obesity among smokers and drinkers varies across studies. One study revealed that 33.3% of smokers calling an official helpline to quit smoking were obese (O'Donovan et al. 2018). Another study showed that smoking is associated with weight loss, with light, moderate, and heavy smokers weighing 3.2, 2.4, and 4.0 kg less than non-smokers, respectively (Abdullozoda 2004).

Recent studies indicate that smoking cessation can lead to weight gain, with former smokers showing a higher prevalence of obesity compared to current smokers. For instance, a study conducted on a large UK population revealed that former smokers are more likely to be obese than both current smokers and never smokers, with a persistent risk of obesity even years after quitting (Dare et al. 2015). Another study found that although smoking cessation is associated with significant weight gain, it does not diminish the health benefits of quitting, including reduced all-cause mortality (Sahle et al., 2021). A study in China also confirmed a modest weight increase after smoking cessation, without significant changes in the prevalence of obesity, highlighting the complexity of this relationship (Callison et al. 2021). These findings emphasize the need for weight management support as part of smoking cessation programs.

Recent studies have explored the complex relationship between alcohol consumption frequency and obesity risk, revealing a bell-shaped association. Lu et al. found that heavy alcohol consumption significantly increases obesity risk, while moderate drinking does not confer protective health benefits (Lu et al., 2023). Another study conducted in Ireland indicated that harmful alcohol consumption is associated with higher body mass index and waist circumference, although this association becomes nonsignificant when accounting for other alcohol-related variables (AlKalbani and Murrin 2023). Souza and Rocha discussed that mild to moderate alcohol consumption is not a significant risk factor for overweight, emphasizing the need for more detailed studies to understand the multifactorial nature of obesity (Souza and Rocha 2023). These findings underscore the importance of considering drinking patterns and other lifestyle factors when assessing the impact of alcohol on obesity. Overall, the prevalence of obesity among smokers and drinkers may vary

depending on various factors such as smoking intensity, smoking cessation, and alcohol consumption frequency.

Regarding dietary habits, our results showed that the risk of overweight/obesity is very high among adults who consume fruits less than 3 times a week ($p = 0.03$; OR = 2.004) and have a dietary intake of red meat more than 4 times a week ($p = 0.006$; OR = 1.57), confectionery products ($p = 0.018$; OR = 1.50), and fast food ($p < 0.0001$). These results are consistent with the majority of studies in the literature. Indeed, overweight and obesity in adults are influenced by dietary habits, particularly fruit consumption. Studies have shown that habit-based interventions, such as adopting new habits or breaking old ones, can lead to maintaining clinically significant weight loss after a 12-month follow-up (Cleo et al., 2019). The studies show a strong correlation between fruit consumption and the reduction of overweight and obesity risk. For example, a study conducted in Iran found that fruit and vegetable consumption is significantly associated with lower risks of obesity and overweight in adults (Nouri et al. 2023). Similarly, a study in Peru demonstrated a negative association between fruit intake per serving and body mass, while fruit juice consumption was linked to an increase in BMI. In Turkey, research indicated that overweight and obese individuals consumed fewer fruits and vegetables compared to their normal-weight counterparts (Hizli-Guldemir et al., 2023). Finally, a study conducted in the Gulf countries showed that increased fruit and vegetable consumption reduces inflammatory markers and oxidative stress in obese subjects, regardless of weight loss (Gariballa et al. 2023).

Studies indicate a significant association between red meat consumption and the risk of overweight and obesity. Furthermore, a cross-sectional study in Iran indicated that higher consumption of white meat and poultry was associated with an increased risk of general obesity, while processed meat was linked to central obesity (Khodayari et al., 2022).

In Canada, high consumption of sugary drinks, including fruit beverages, has been linked to overweight and obesity. Primary care providers play a crucial role in promoting healthy dietary habits, such as increasing the intake of low-energy-density foods like fruits and vegetables while discouraging the consumption of sugar-added beverages. This approach can assist adults in maintaining or losing weight effectively (Malik et al. 2006). However, it is important to note that while some studies have found a significant association between red meat consumption and obesity, others have not (Daneshzad et al., 2021). This may be due to several factors, including the type of meat consumed (processed or unprocessed) and individual genetic factors (Pereira da Silva et al., 2020). The evidence on the link between red meat consumption and obesity is inconclusive. Some studies suggest a positive connection, while others have found no significant association. Further

research is required to gain a better understanding of the potential impact of red meat consumption on the risk of obesity.

Regarding the consumption of confectionery and fast food, the study conducted by Cheah et al. revealed that sociodemographic factors such as income, education, gender, ethnic origin, and professional status were significantly associated with confectionery consumption among obese and non-obese adults in Malaysia (Cheah et al., 2020). However, Abdullah et al.'s study did not find a significant association between fast food consumption and obesity in Malaysian adults (Abdullah et al., 2017). On the other hand, Machado et al.'s study revealed a significant association between the consumption of ultra-processed foods, including fast food, and obesity in the adult Australian population (Machado et al., 2019). Overall, although the relationship between fast food consumption and obesity in adults is not consistent across all studies, evidence suggests that the consumption of ultra-processed foods, including fast food, may contribute to obesity.

Conclusion

The prevalence of overweight and obesity is higher among the population of Casablanca, and it can be attributed to various factors such as dietary habits, diabetes, and hypertension. Based on our findings, we recommend implementing an awareness program to prevent overweight and obesity and the associated diseases. The program should include initiatives for nutritional education to promote healthy eating habits and regular physical activity. The alarming increase in overweight and obesity among the adult population of Casablanca highlights the need for taking measures to counter this public health problem. To combat this trend, we suggest implementing awareness programs aimed at preventing overweight and obesity, along with the diseases associated with them. These programs should include initiatives for nutritional education to promote a healthy and balanced diet, as well as regular physical activity. It is also crucial to raise awareness about the importance of diabetes and hypertension prevention and screening, especially among adults who are at risk.

Moreover, a comprehensive health approach, including personalized advice and medical monitoring, could be beneficial for individuals with risk factors. By mobilizing community resources and fostering collaboration among healthcare professionals, educators, and local authorities, it is possible to implement effective measures to combat obesity and promote a healthy lifestyle.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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References

Abdullah, N., Mohamad Mokhtar, M., Bakar, M., And Al-Kubaisy, W. (2017). Fast Food Consumption and Obesity. *Asia. J. QoL. 2*, 11. https://doi.org/10.21834/ajqol.v2i6.42

Abdullozoda, S.M. (2022). Prevalence of obesity among the adult population of tajikistan. Avicenna bulletin. 1,19-28

Agrawal, P., Gupta, K., Mishra, V., And Agrawal, S. (2013). Effects of Sedentary Lifestyle and Dietary Habits on Body Mass Index Change among Adult Women in India : Findings from a Follow-Up Study. *Ecol. food. nutr. 52*(5), 387‑406.https://doi.org/10.1080/03670244.2012.719346

AlKalbani, S. R., And Murrin, C. (2023). The association between alcohol intake and obesity in a sample of the Irish adult population, a cross-sectional study. *BMC Public Health*, *23*(1), 2075. https://doi.org/10.1186/s12889-023-16946-4

Appel, S. J., Jones, E. D., And Kennedy- Malone, L. (2004). Central Obesity and the Metabolic Syndrome : Implications for Primary Care Providers. *J. Am. Acad. Nurse. Pract. 16*(8), 335‑342. https://doi.org/10.1111/j.1745-7599.2004.tb00456.x

Barich, F., Zahrou, F. E., Laamiri, F. Z., El Mir, N., Rjimati, M., Barkat, A., Rjimati, E. A., And Aguenaou, H. (2018). Association of Obesity and Socioeconomic Status among Women of Childbearing Age Living in Urban Area of Morocco. *J. Nutr. Metab. 2018* (1), 6043042. https://doi.org/10.1155/2018/6043042

Bovet, P., Ross, A. G., Gervasoni, J.-P., Mkamba, M., Mtasiwa, D. M., Lengeler, C., Whiting, D., And Paccaud, F. (2002). Distribution of blood pressure, body mass index and smoking habits in the urban population of Dar es Salaam, Tanzania, and associations with socioeconomic status. *Inte. J. Epi. 31*(1), 240‑247. https://doi.org/10.1093/ije/31.1.240

Callison, K., Schiman, C., And Schiman, J. C. (2021). Smoking cessation and weight gain : Evidence from China. *Eco. Human. Bio. 43*, 101045. https://doi.org/10.1016/j.ehb.2021.101045

Cheah, Y. K., Azahadi, M., Mohamad Nor, N. S., Phang, S. N., And Abd Manaf, N. H. (2020). Sociodemographic factors associated with consumption of confectionery among obese and non-obese adults : A secondary analysis. *Obes. Res. Clin. Pract.*, *14*(5), 428‑436. https://doi.org/10.1016/j.orcp.2020.07.008

Chen, L., Zhang, J., Zhou, N., Weng, J.-Y., Bao, Z.-Y., And Wu, L.-D. (2023). Association of different obesity patterns with hypertension in US male adults : A cross-sectional study. *Sci Rep. 13*(1), 10551. https://doi.org/10.1038/s41598-023-37302-x

Cleo, G., Glasziou, P., Beller, E., Isenring, E., And Thomas, R. (2019). Habit-based interventions for weight loss maintenance in adults with overweight and obesity : A randomized controlled trial. *Inter. J. Obes. (2005)*, *43*(2), 374‑383. https://doi.org/10.1038/s41366-018-0067-4

Çolak, Y., And Melihamervehız. (2022). The relation between obesity and hypertension. *The Atl. 2*(3), 59‑62. https://doi.org/10.55358/atjmed.2022.08.014

Daneshzad, E., Askari, M., Moradi, M., Ghorabi, S., Rouzitalab, T., Heshmati, J., And Azadbakht, L. (2021). Red meat, overweight and obesity : A systematic review and meta-analysis of observational studies. *Clin. Nutr. ESPEN. 45*, 66‑74.https://doi.org/10.1016/j.clnesp.2021.07.028

Dare, S., Mackay, D. F., And Pell, J. P. (2015). Relationship between Smoking and Obesity : A Cross-Sectional Study of 499,504 Middle-Aged Adults in the UK General Population. *PLoS ONE*. *10*(4), e0123579. https://doi.org/10.1371/journal.pone.0123579

Després, J. P., Pascot, A., And Lemieux, I. (2000). Risk factors associated with obesity : A metabolic perspective. *Ann. endocrinol. 61 Suppl 6*, 31‑38.

El Rhazi, K., Nejjari, C., Romaguera, D., Feart, C., Obtel, M., Zidouh, A., Bekkali, R., And Gateau, P. B. (2012). Adherence to a Mediterranean diet in Morocco and its correlates : Cross-sectional analysis of a sample of the adult Moroccan population. *BMC Public Health*. 12, 345. https://doi.org/10.1186/1471-2458-12-345

El Rhazi, K., Nejjari, C., Zidouh, A., Bakkali, R., Berraho, M., And Barberger Gateau, P. (2011). Prevalence of obesity and associated sociodemographic and lifestyle factors in Morocco. *Pub Health Nutr. 14*(1), 160‑167. https://doi.org/10.1017/S1368980010001825

Epidémiologie de l'obésité en Tunisie(Tunisia)Etude HSHS*4 (Hammam Sousse Sahloul Heart Study). (2022). *Tunis Méd. 100*, 551‑560.

Gariballa, S., Al-Bluwi, G. S. M., And Yasin, J. (2023). Increased Fruit and Vegetable Consumption Mitigates Oxidative Damage and Associated Inflammatory Response in Obese Subjects Independent of Body Weight Change. *Nutr. 15*(7), https://doi.org/10.3390/nu15071638

Hizli-Guldemir, H., Saleki, N., Sezer, F. E., Yoldas-Ilktac, H., Akman, C., Ersoy, G., And Garipagaoglu, M. (2023). Vegetable and Fruit Consumption and Its Relationship with Body Mass Index in Adults : A Cross-Sectional and Seasonal Research from Türkiye. *Inter. J. Enviro. Health Res. 33*(11), 1168‑1179. https://doi.org/10.1080/09603123.2023.2214504

Mohtadi K, Msaad R, Benalioua N, Jafri A, Meftah H, Elkardi Y, Lebrazi H, Kettani A, Derouiche A, Taki H and Saïle R. (2020). Sociodemographic and Lifestyle Factors Associated with Adherence to Mediterranean Diet in Representative Adult Population in Casablanca City, Morocco : A Cross-Sectional Study. *J. Nutr. Metab, 2020*. https://doi.org/10.1155/2020/3105271

Kaoutar, K., Chetoui, A., Boutahar, K., Moussaoui, S. E., Kardoudi, A. E., Chigr, F., And Najimi, M. (2022). Nutritional status in Morocco. *Inter.j. Res. Ethics. 5*(2).59-64 https://doi.org/10.51766/ijre.v5i2.172

Khanal, P. (2022). Socio-Demographic and Health Status of Women in Nepal. *J. Popul. Dev.3*(1),93-105 https://doi.org/10.3126/jpd.v3i1.48809

Khodayari, S., Sadeghi, O., Safabakhsh, M., And Mozaffari-Khosravi, H. (2022). Meat consumption and the risk of general and central obesity : The Shahedieh study. *BMC Res.Notes. 15*(1), 339. https://doi.org/10.1186/s13104-022-06235-5

Kinnunen, T. I., Bastola, K., And Neupane, S. (2021). Trends in the Prevalence of Overweight and Obesity Among Women of Reproductive Age. *J.Nep. Health Res. Counc. 19*(2), 252‑258. https://doi.org/10.33314/jnhrc.v19i2.3292

Lessem, A., And Trapp, C. (2022). Preventing, Treating, and Reversing Chronic Disease With Nutritional Interventions. In *Lifestyle Nursing*. from: https://www.ncbi.nlm.nih.gov/books/NBK589672/

Lu, T., Nakanishi, T., Yoshiji, S., Butler-Laporte, G., Greenwood, C. M. T., And Richards, J. B. (2023). Dose-dependent Association of Alcohol Consumption With Obesity and Type 2

Diabetes : Mendelian Randomization Analyses. *The J.Clinic. Endocri. Metab. 108*(12), 3320‑3329. https://doi.org/10.1210/clinem/dgad324

Machado, P. P., Steele, E. M., Levy, R. B., Sui, Z., Rangan, A., Woods, J., Gill, T., Scrinis, G., And Monteiro, C. A. (2019). Ultra-processed foods and recommended intake levels of nutrients linked to non-communicable diseases in Australia : Evidence from a nationally representative cross-sectional study. *BMJ Open*. *9*(8), e029544. https://doi.org/10.1136/bmjopen-2019-029544

Malik, V. S., Schulze, M. B., And Hu, F. B. (2006). Intake of sugar-sweetened beverages and weight gain : A systematic review. *The Am. j. clinic. nutr. 84*(2), 274‑288.

Marques, A., Peralta, M., Naia, A., Loureiro, N., And de Matos, M. G. (2018). Prevalence of adult overweight and obesity in 20 European countries, 2014. *Eur. J. Pub. Health. 28*(2), 295‑300.https://doi.org/10.1093/eurpub/ckx143

Ministry of Health, Morocco. (2017). Enquête Nationale sur les Facteurs de Risque communs des Maladies Non Transmissibles (p. 120). Ministère de la Santé. from: https://www.sante.gov.ma/Documents/2019/05/Rapport%20de%20l%20enqu%C3%AAte%20Stepwise.pdf

Mohajan, D., And Mohajan, H. K. (2023). Obesity and Its Related Diseases : A New Escalating Alarming in Global Health. *J.Innov. Med. Res. 2*(3), 12-23.

Mouzouni, F.-Z., Mehdad, S., Mounach, S., Iraqi, H., Benkirane, H., Benaich, S., EL Youbi, M., And Aguenaou, H. (2022). Diabetes prevalence is associated with obesity, hypertension, dyslipidemia, and sociodemographic factors in adults living in Casablanca-Settat and Rabat-Sale-Kenitra regions, Morocco. *Inter. J. Diabetes in Developing Countries*, *42*(3), 565‑572. https://doi.org/10.1007/s13410-021-01006-7

Nouri, M., Shateri, Z., And Faghih, S. (2023). The relationship between intake of fruits, vegetables and dairy products with overweight and obesity in a large sample in Iran : Findings of STEPS 2016. *Front. Nutr. 9*. https://doi.org/10.3389/fnut.2022.1082976

O'Donovan, G., Stamatakis, E., And Hamer, M. (2018). Associations between alcohol and obesity in more than 100 000 adults in England and Scotland. *Br. J. Nutr. 119*(2), 222‑227. https://doi.org/10.1017/S000711451700352X

Passos, C. M. dos, Maia, E. G., Levy, R. B., Martins, A. P. B., And Claro, R. M. (2020). Association between the price of ultra-processed foods and obesity in Brazil. *Nutr, Metab. Cardiovasc. Dis. 30*(4), 589‑598. https://doi.org/10.1016/j.numecd.2019.12.011

Pereira da Silva, A., Costa, M. do C., Aguiar, L., Matos, A., Gil, Â., Gorjão-Clara, J., Polónia, J., And Bicho, M. (2020). Impact on Longevity of Genetic Cardiovascular Risk and Lifestyle including Red Meat Consumption. *Oxidative Medicine and Cellular Longevity*, *2020*, 1305413. https://doi.org/10.1155/2020/1305413

Sahle, B. W., Chen, W., Rawal, L. B., And Renzaho, A. M. N. (2021). Weight Gain After Smoking Cessation and Risk of Major Chronic Diseases and Mortality. *JAMA Net. Open*, *4*(4), e217044. https://doi.org/10.1001/jamanetworkopen.2021.7044

Saxton, S. N., Clark, B. J., Withers, S. B., Eringa, E. C., And Heagerty, A. M. (2019). Mechanistic Links Between Obesity, Diabetes, and Blood Pressure : Role of Perivascular Adipose Tissue. *Physiol. Rev. 99*(4), 1701‑1763. https://doi.org/10.1152/physrev.00034.2018

Sheng, Z., Lou, S., Cao, J., Sun, W., Shen, Y., Xu, Y., Ren, Z., Liu, W., Yi, Q., And Song, P. (2023). The associations of obesity phenotypes with the risk of hypertension and its

transitions among middle-aged and older Chinese adults. *Epidemiol.Health. 45*, e2023043. https://doi.org/10.4178/epih.e2023043

Sievenpiper, J. L., Riccardi, G., Ricordi, C., And Dembska, K. (2019). Nutrition, Health and Dietary Trends. In R. Valentini, J. L. Sievenpiper, M. Antonelli, And K. Dembska (Éds.), *Achieving the Sustainable Development Goals Through Sustainable Food Systems* 63‑82. Springer International Publishing. https://doi.org/10.1007/978-3-030-23969-5_4

Sogari, G., Velez-Argumedo, C., Gómez, M. I., And Mora, C. (2018). College Students and Eating Habits : A Study Using An Ecological Model for Healthy Behavior. *Nutr.10*(12), 1823. https://doi.org/10.3390/nu10121823

Souza e Souza, L., And Rocha, S. (2023). Association between alcohol consumption and overweight in adults : Brief notes on biological plausibility. *Inter. J. Sci. Res. Arch. 9*, 236‑243. https://doi.org/10.30574/ijsra.2023.9.1.0372

Tazi, M. A., Abir-Khalil, S., Chaouki, N., Cherqaoui, S., Lahmouz, F., Sraïri, J. E., And Mahjour, J. (2003). Prevalence of the main cardiovascular risk factors in Morocco : Results of a National Survey , 2000. *J. Hypertens. 21*(5), 897.