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EFFECTS OF SMOKING ON ENDOCRINE AND LIPID DISTURBANCES IN KSA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: This research aims to determine the Effects of Smoking on Endocrine and Lipid Disturbances in KSA

Methods: This study will employ a cross-sectional design to assess the effects of smoking on endocrine function and lipid disturbances among adults in Saudi Arabia. The design is appropriate for exploring associations between smoking habits and metabolic outcomes at a single point, allowing for examining hormonal and lipid profile abnormalities.

Results: The study included 560 participants. The most frequent gender among them was male (n= 363, 64.82%) and female (n= 197, 35,17%). The most frequent age among study participants was 31-35 years (n= 210, 37.5%) followed by 25-30 years (n= 176, 31.4%), then 36-40 years (n=109, 19.5%), 40 and more (n=45, 8%) and less than 25 (n=20, 3.6%). The most frequent Marital status among study participants was single (n= 320, 57.1%), followed by married (n= 122, 21.8%), then divorced (n=88, 15.7%), and widow (n=30, 5.4%). Nationality among study participants, with most being Saudi (n=513, 91.6%) and non-Saudi (n=47, 8.4%). %). Participants were asked

if they smoked. There were participants Non-smokers (n= 319, 56.9%), followed by current smokers (n=192, 34.28%) and Ex-smokers (n=49, 8.7%).

Conclusion: This study highlights the significant impact of smoking on endocrine function and lipid profiles among adults in Saudi Arabia. The findings suggest that smokers are more prone to lipid imbalances and endocrine disturbances, which are critical risk factors for chronic diseases such as cardiovascular disease and metabolic syndrome. The data underline the importance of targeted public health interventions to address smoking-related health risks and encourage cessation programs to mitigate these adverse effects.

INTRODUCTION

Tobacco use has long been recognized as a leading cause of many diseases and deaths across the globe [1], making it one of the most significant health crises of the 20th century. Chronic and acute harmful diseases, including lung disease, cancer, coronary heart disease, and a decline in self-reported health leading to missed school or work days or even death, are among the many negative outcomes that smokers are likely to experience [2,3]. The widespread use of tobacco products further exacerbates these effects. As an example, the dramatic increase in tobacco sales in relation to the population expansion in Saudi Arabia lends credence to the fact that the prevalence of smoking among men varies from 13% to 38% [4,5]. There is a larger incidence in men (26% vs 5%, respectively) and a pooled prevalence of 17% among college students [6]. In the kingdom, smoking has long been associated with an increased risk of cardiovascular disease, and it poses a serious and growing danger of other tobacco-related disorders, like COPD, in the future [7].

An abnormal increase in total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG) and a reduction in high-density lipoprotein cholesterol (HDL-C) define hyperlipidemia, a disorder in which blood lipid levels become abnormal. Adults worldwide have a higher prevalence of hyperlipidemia. Here in the US, for example, lipid problems affect almost 53% (105.3 million) of adults [8]. The total prevalence of hyperlipidemia in China is 34.0 percent, with urban regions having a frequency of 35.1 percent and rural areas of 26.3 percent, according to studies [9]. Hyperlipidemia prevalence has risen in China during the last several decades, mirroring changes in lifestyle [10]. Five3.6 percent of Chinese people (aged 35–74) had either borderline hyperlipidemia or developed hyperlipidemia, according to a research conducted between 2000 and 2001 by the International Collaborative research of Cardiovascular Disease in Asia [11]. Men in China had a much greater prevalence of hyperlipidemia (41.9% vs. 32.5% in women) [9]. As a result, projections show that 78 million individuals would suffer from hyperlipidemia in developed nations by 2022, with China accounting for one-sixth of all instances [12-13].

Cardiovascular disease (CVD) risk factors include hyperlipidemia [14]. Over 4 million people die each year as a direct result of hyperlipidemia, and the condition is linked to over 50% of all occurrences of heart disease [15]. Coronary heart disease (CHD) risk increases with both high triglycerides and low-density lipoprotein (LDL) cholesterol, as has been previously observed [16]. citations[17, 18]. There is an inverse relationship between coronary heart disease and HDL-C concentrations, according to many prospective studies. So, it's no secret that low HDL-C levels increase the likelihood of coronary heart disease [19-20]. In addition, several research studies have shown that some modifiable risk factors, including smoking, significantly increase the likelihood of developing cardiovascular diseases (CVD). Therefore, the purpose of this cross-sectional research is to evaluate the impact of smoking on lipid abnormalities and endocrine function in the adult population of Saudi Arabia (KSA).

METHODS

Study design

This study will employ a cross-sectional design to assess the effects of smoking on endocrine function and lipid disturbances among adults in Saudi Arabia. The design is appropriate for exploring associations between smoking habits and metabolic outcomes at a single point in time, allowing for the examination of both hormonal and lipid profile abnormalities.

Study approach

The study will be conducted in several healthcare facilities across Saudi Arabia, including public and private hospitals, outpatient clinics, and community health centers. Data collection will take place in these settings to ensure diverse representation of participants from different regions and backgrounds.

Study population

The target population includes adult male and female residents of Saudi Arabia, aged 18 years and above. Participants will be divided into two main groups: smokers and non-smokers, with further subgroup analysis based on smoking intensity and duration.

Study sample

A sample size of approximately 560 participants will be recruited using a stratified random sampling method to ensure representation across age groups, gender, and smoking status. Stratification will also consider regional distribution within Saudi Arabia to capture potential geographic variations in the metabolic effects of smoking.

Study tool

For the current study, a questionnaire was adopted for data collection, also categorized as a study tool.

Data collection

Data will be collected through a combination of structured questionnaires and clinical assessments. The questionnaire will cover demographic information, smoking history, lifestyle factors, and medical history. Blood samples will be drawn from participants to measure hormone levels (e.g., insulin, cortisol, thyroid hormones) and lipid profiles (cholesterol, triglycerides, LDL, HDL).

Data analysis

Descriptive statistics will be used to summarize the participants' demographic characteristics and smoking prevalence. The relationship between smoking and endocrine and lipid disturbances will be assessed using multivariate regression analysis, adjusting for potential confounders such as age, gender, and lifestyle factors. A p-value of <0.05 will be considered statistically significant.

Ethical considerations

Ethical approval for the study will be obtained from the institutional review board (IRB) of the participating healthcare facilities. Informed consent will be obtained from all participants prior to data collection. Confidentiality of participant data will be maintained, and participants will have the right to withdraw from the study at any time without any consequences. The study will adhere to the ethical guidelines of the Declaration of Helsinki.

RESULTS

The study included 560 participants. The most frequent gender among them was male (n= 363, 64.82%) and female (n= 197, 35,17%). Figure 1 shows the gender distribution among study participants. The most frequent age among study participants was 31-35 years (n= 210, 37.5%)

followed by 25-30 years (n= 176, 31.4%), then 36-40 years (n=109, 19.5%), 40 and more (n=45, 8%) and less than 25 (n=20, 3.6%). Figure 2 shows the age distribution among study participants. The most frequent Marital status among study participants was single (n= 320, 57.1%) followed by married (n= 122, 21.8%), then divorced (n=88, 15.7%) and widow (n=30, 5.4%). Figure 3 shows the marital status distribution among study participants.

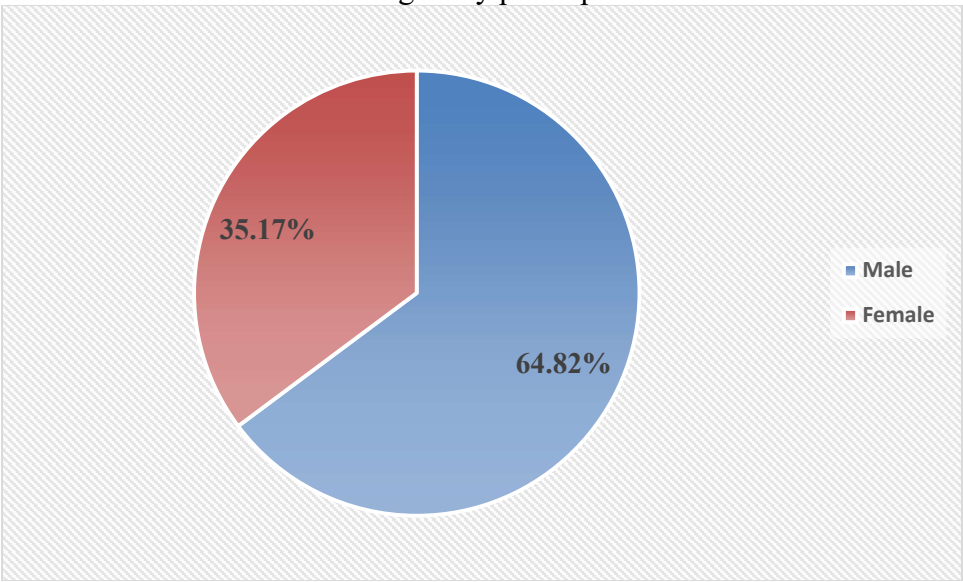


Figure 1: Gender distribution among study participants

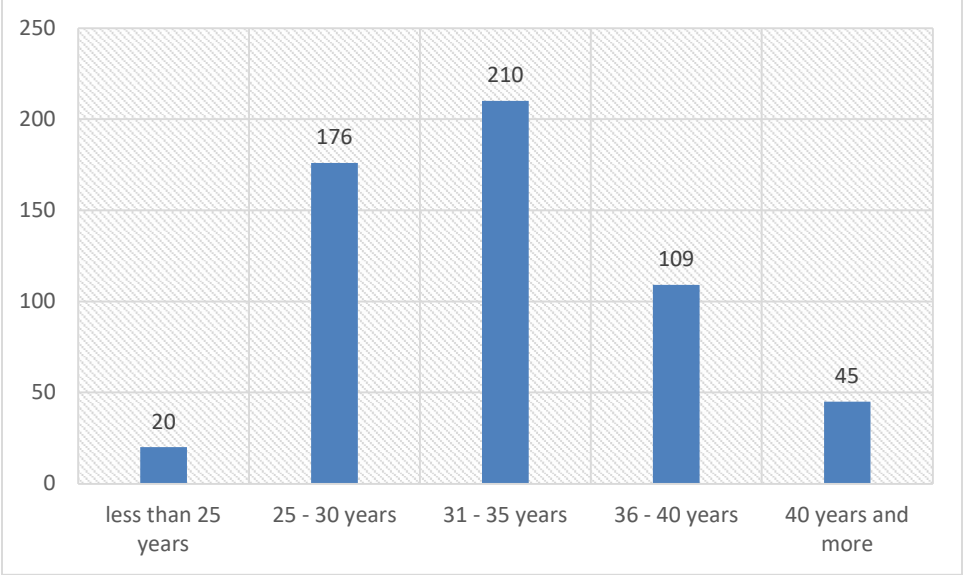


Figure 2: Age distribution among study participants

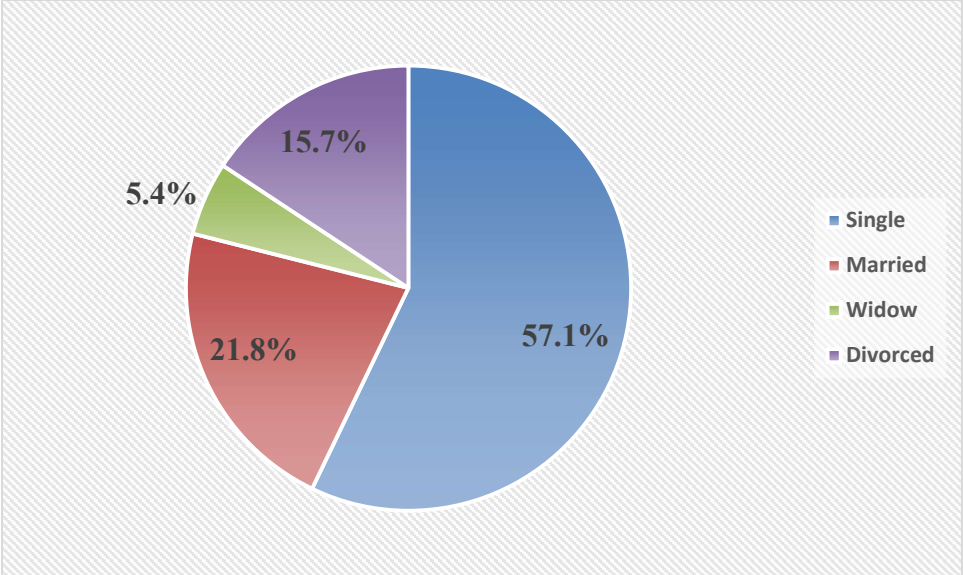


Figure 3: Marital status distribution among study participants

Nationality among study participants, with most being Saudi (n=513, 91.6%) and non-Saudi (n=47, 8.4%). %). Figure 4 shows the nationality distribution among study participants.

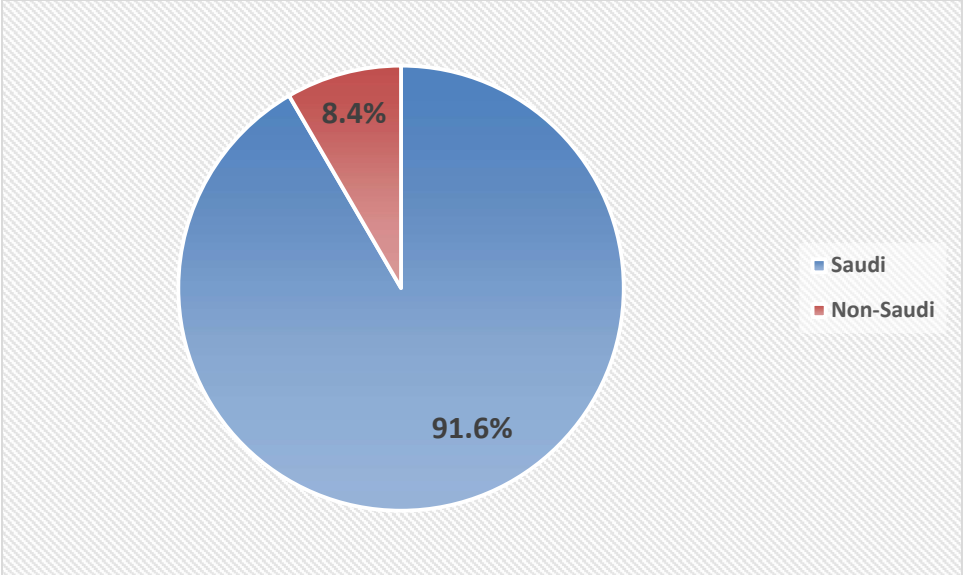


Figure 4: Nationality distribution among study participants

Participants were asked if they smoked. There were participants Non-smokers (n= 319, 56.9%), followed by current smokers (n=192, 34.28%) and Ex-smokers (n=49, 8.7%). Figure 5 shows the smoking status distribution among study participants.

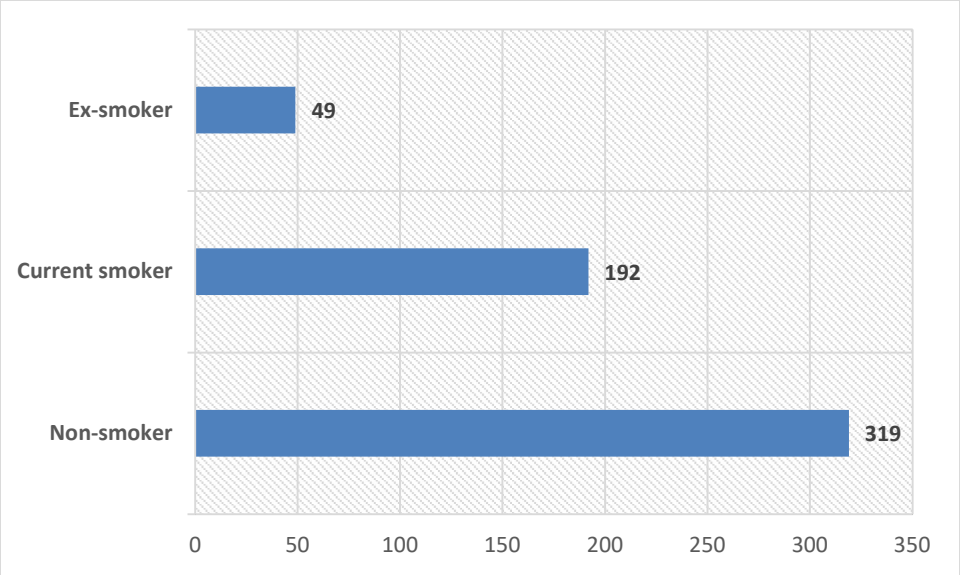


Figure 5: Smoking status distribution among study participants

The participants were asked whether they suffer from any of the following chronic diseases, and the results of their responses are shown in table 1.

Table 1: Do you suffer from the following diseases?

Do you suffer from the following conditions?	Yes		No	
Hyperlipidemia	12	2.1%	548	97.9%
Hypercholesterolemia	13	2.3%	547	97.7%
Hypertriglyceridemia	54	9.6%	506	90.4%
Low HDL levels	27	4.8%	533	95.2%
Type 1 DM	64	11.4%	496	88.6%
Type 2 DM	70	12.5%	490	87.5%
Hyperthyroidism	40	7.3%	510	92.7%
Hypothyroidism	22	3.9%	538	96.1%
Infertility	53	9.5%	507	90.5%
Galactorrhea (Men)	5	0.9%	555	99.1%
Cushing disease	7	1.3%	553	98.8%
PCOS (Women)	91	16.3%	469	83.8%
Menstruation issues (Women)	82	14.6%	478	85.4%
Metabolic syndrome	70	12.5%	490	87.5%

DISCUSSION

Smoking remains one of the most significant modifiable risk factors for a multitude of chronic diseases, including cardiovascular disease, cancer, and respiratory illnesses. Despite global awareness campaigns about the dangers of smoking, its prevalence remains high in many parts of the world, contributing to an ongoing public health crisis. A growing body of evidence indicates that smoking can also cause profound disruptions in endocrine function and lipid metabolism, leading to metabolic disturbances that can further exacerbate disease risks [21-22].

Smoking and Endocrine Disturbances

Impact on Insulin and Glucose Homeostasis

The relationship between smoking and insulin resistance is well-documented. Smokers are at a higher risk of developing type 2 diabetes compared to non-smokers due to disruptions in insulin signaling pathways. Nicotine, a major component of tobacco, is believed to impair insulin sensitivity by increasing the levels of free fatty acids (FFAs) in circulation, which in turn inhibit glucose uptake in skeletal muscle and adipose tissue [23]. A study found that active smokers exhibited a 30-40% increased risk of type 2 diabetes, with evidence suggesting that smoking induces systemic inflammation, thereby impairing insulin action [24].

Smoking also stimulates the sympathetic nervous system, leading to the release of catecholamines such as adrenaline and noradrenaline. These hormones are known to raise blood glucose levels by promoting gluconeogenesis and glycogenolysis in the liver, further contributing to insulin resistance. Chronic exposure to nicotine can exacerbate this condition, placing long-term smokers at heightened risk for metabolic syndrome, a cluster of conditions that includes insulin resistance, hyperglycemia, and dyslipidemia [25].

Effects on Thyroid Function

The thyroid gland plays a crucial role in regulating metabolic processes through the secretion of thyroid hormones, including thyroxine (T4) and triiodothyronine (T3). Smoking has been linked to both hyperthyroidism and hypothyroidism, depending on various factors such as genetic predisposition and iodine status. The presence of thiocyanate, a byproduct of cyanide metabolism in smokers, inhibits iodine uptake by the thyroid gland, leading to disruptions in hormone synthesis [26].

Studies have shown that smokers are more likely to develop Graves' disease, an autoimmune disorder that results in hyperthyroidism. A meta-analysis found that smoking increased the risk of Graves' disease by up to 3 times in women and 4 times in men. On the other hand, hypothyroidism has also been observed among smokers, particularly when smoking is combined with iodine deficiency. This dual effect suggests that smoking may act as both a stimulant and a disruptor of thyroid function, depending on individual and environmental factors [27-28].

Cortisol and Stress Response

Smoking has a profound impact on the hypothalamic-pituitary-adrenal (HPA) axis, which governs the body's stress response through the release of cortisol. Nicotine stimulates the release of corticotropin-releasing hormone (CRH) from the hypothalamus, thereby increasing the production of adrenocorticotropic hormone (ACTH) and cortisol. Elevated cortisol levels can lead to several adverse health outcomes, including increased abdominal fat deposition, immune suppression, and insulin resistance [29].

Studies have demonstrated that chronic smokers exhibit higher baseline cortisol levels compared to non-smokers, suggesting that smoking may induce a state of chronic stress. This prolonged elevation of cortisol not only affects metabolic function but also contributes to the addictive nature of smoking by modulating reward pathways in the brain. The role of cortisol in smoking-induced

endocrine disturbances underscores the complex interplay between smoking, stress, and metabolic health [30].

Smoking and Lipid Disturbances

Dyslipidemia and Smoking

Dyslipidemia, characterized by abnormal levels of lipids in the blood, is a major risk factor for cardiovascular disease. Smokers are particularly prone to dyslipidemia, with studies showing that smoking leads to elevated levels of low-density lipoprotein (LDL) cholesterol and triglycerides, coupled with decreased levels of high-density lipoprotein (HDL) cholesterol. This lipid imbalance promotes atherosclerosis, a condition where fatty deposits build up in the arteries, increasing the risk of heart attack and stroke [31].

The mechanism by which smoking induces dyslipidemia is multifaceted. Nicotine and other tobacco constituents stimulate the release of catecholamines, which promote lipolysis in adipose tissue, resulting in the release of FFAs into the bloodstream. These FFAs are taken up by the liver, where they are converted into triglycerides and released as very low-density lipoprotein (VLDL) particles, leading to hypertriglyceridemia. Additionally, oxidative stress induced by smoking leads to the oxidation of LDL particles, which are more likely to be taken up by macrophages in the arterial wall, contributing to atherogenesis [32].

CONCLUSION

This study highlights the significant impact of smoking on endocrine function and lipid profiles among adults in Saudi Arabia. The findings suggest that smokers are more prone to lipid imbalances and endocrine disturbances, which are critical risk factors for chronic diseases such as cardiovascular disease and metabolic syndrome. The data underline the importance of targeted public health interventions to address smoking-related health risks and encourage cessation programs to mitigate these adverse effects.

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ANNEX 1: DATA COLLECTION TOOL

Age			Gender			Male	Female
Education	Illiterate		School			University	
Marital Status	Single		Married		Widow		Divorced
Employment	Unemployed		Student			Governmental	
	Private		Self-employed/ freelancer			Retired	
Level of income	Weak		Good/average			High	
Residency place	Urban (city				Rural (countryside)		

Smoking status	Non-smoker		Ex-smoker	Current smoker
Smoking amount (Pack per day)			Duration (years)	
Comorbid conditions	Yes	No		

Blood tests values (if present "latest)			
Total Cholesterol		LDL cholesterol	
HDL cholesterol		Triglycerides	
TSH		Free T4	
Fasting blood glucose		HbA1c	
Prolactin		Cortisol	
Insulin		FSH	
Testosterone (men)		Estrogen (women)	
AMH (Women)		Progesterone (Women)	

Do you suffer from the following conditions?	Yes	No
Hyperlipidemia		
Hypercholesterolemia		
Hypertriglyceridemia		
Low HDL levels		
Type 1 DM		
Type 2 DM		
Hyperthyroidism		
Hypothyroidism		
Infertility		
Galactorrhea (Men)		
Cushing disease		
PCOS (Women)		
Menstruation issues (Women)		
Metabolic syndrome		

APPENDIX 2: Participants responses to scale items

Gender	Frequency	Percentage
Male	363	64.8%
Female	197	35.1%

Age	Frequency	Percentage
less than 25 years	20	3.6%
25 - 30 years	176	31.4%
31 - 35 years	210	37.5%
36 - 40 years	109	19.5%

40 years and more	45	8.0%

Marital status	Frequency	Percentage
Single	320	57.1%
Married	122	21.8%
Widow	30	5.4%
Divorced	88	15.7%

Education	Frequency	Percentage
University	469	83.70%
School	50	8.90%
Postgraduate Studies	41	7.32%

Nationality	Frequency	Percentage
Saudi	513	91.6%
Non-Saudi	47	8.4%

Smoking status	Frequency	Percentage
Non-smoker	319	56.90%
Current smoker	192	34.28%
Ex-smoker	49	8.70%

Duration (years)	Frequency	Percentage
0	320	57.1%
3	41	7.3%
4	23	4.1%
5	52	9.3%
7	36	6.4%
8	30	5.4%
9	18	3.2%
10	27	4.8%
30	13	2.3%

Comorbid conditions	Frequency	Percentage
No	487	86.9%
Yes	73	13.0%

Blood tests values (if present "latest)	Normal	Abnormal
Total Cholesterol	510	30
HDL cholesterol	518	42
TSH	555	5
Fasting blood glucose	498	62
Prolactin	540	20
Insulin	557	3
Testosterone (men)	509	51
AMH (Women)	540	20
LDL cholesterol	548	12
Triglycerides		
Free T4		
HbA1c	480	80
Cortisol	526	34
FSH	560	0
Estrogen (women)	539	21
Progesterone (Women)	530	30

Do you suffer from the following conditions?	Yes		No	
Hyperlipidemia	12	2.1%	548	97.9%
Hypercholesterolemia	13	2.3%	547	97.7%
Hypertriglyceridemia	54	9.6%	506	90.4%
Low HDL levels	27	4.8%	533	95.2%
Type 1 DM	64	11.4%	496	88.6%
Type 2 DM	70	12.5%	490	87.5%
Hyperthyroidism	40	7.3%	510	92.7%
Hypothyroidism	22	3.9%	538	96.1%
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Menstruation issues (Women)	82	14.6%	478	85.4%

Metabolic syndrome	70	12.5%	490	87.5%