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# From the Editor



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In this issue several papers from the region discussed topics of interest to internal medicine including inflammatory bowel diseases, hypercholesterolemia, obesity, diabetes, colorectal cancer, infection control, thalassemia and heart diseases.

Alzahrani et al., did a retrospective study targeting patient records of all patients with IBD, who were diagnosed with CD and UC over the period between 1980 and 2019 at gastroenterology unit, Aseer central hospital. The data were extracted from the patients' files covering the demographic data, signs and symptoms at the onset of disease, laboratory data, radiological findings, and endoscopic findings. The aim was to assess magnitude, epidemiological pattern, and complications of IBD in Aseer region of Southern Saudi Arabia.

The study included 134 patients, of whom 68 (50.7%) were diagnosed with ulcerative colitis (UC) and 66 (49.3%) with Crohn's disease (CD). Whereas in UC patients the most recorded endoscopic site affected was the descending colon followed by sigmoid colon, and then transverse colon. Anemia was the most frequent complication affecting both groups of patients. The authors concluded that IBD is no longer a uncommon ailment in KSA. UC is in a sound state, while CD is escalating considerably and far outnumbering UC.

A comparative retrospective cross sectional study of obese type 2DM and obese non-diabetic patients was done in Saudi Arabia. A total of 500 Saudi participants (200 obese Type 2 diabetic patients (T2DM) [Group I], 200 obese non-diabetic patients [Group II] and 100 healthy controls [Group III]) were randomly selected using systematic random sampling technique to assess the association of dyslipidemia and other biochemical/ hormonal variables as risk factors in obese T2DM and obese non-diabetic patients. The study has documented several lipid abnormalities in obese type 2 diabetes mellitus & obese non-diabetic patients and has pointed to the significance of diabetic management in the control of lipid abnormalities where the control of overweight and obesity is of utmost importance. That is why in the upcoming studies we will try to detect the pattern of feeding in Saudi people in Aseer Region and its relation to obesity with its subsequents. DM patients as well as obese patients are more prone to dyslipidemia which is an important risk factor for atherosclerosis and

coronary heart disease so they require a special attention to proper feeding, hypolipidaemic drugs to avoid associated co-morbidity of diabetes mellitus. This can be done through health education at the primary care level and the diabetic clinics.

Alzahrani et al., did a descriptive cross-sectional study to identify all accessible populations in the Aseer region of southern Saudi Arabia. Data were collected from participants using an online pre-structured questionnaire. This study assessed population awareness of colorectal cancer and the attitude toward screening and its determinants. A total of 1296 respondents completed the survey. Participants' age ranged from 18 to 65 years, with a mean age of  $29.6 \pm 13.8$  years. A good awareness level was established in nearly one-fifth of the participants. A total of 1236 participants (95.4 %) reported that they would undergo screening if they had any risk factor for colorectal cancer. The main barrier to undergo screening was that participants did not have any symptoms (31.7 %). This survey revealed that the public awareness of colorectal cancer in the Aseer region was overall poor. Participants had some knowledge regarding individual aspects but lacked knowledge of others. We recommend that healthcare staff should pay more attention to improving public awareness of the recommended screening for colorectal cancer.

A paper from Saudi Arabia try to determine the level of compliance to infection control practices among healthcare practitioners in the Kingdom of Saudi Arabia. This cross-sectional study was conducted with 180 healthcare practitioners working in military, university, government and private hospitals in four (4) regions in Saudi Arabia, namely, Riyadh, Najran, Abha and Al Baha. Samples were selected using convenience sampling. Most of the healthcare practitioners were young adults, male, licensed physicians, Saudi citizens, doctoral degree holders, have 1 to 5 years of hospital experience, works in university hospitals, and lastly were assigned in medical ward. Healthcare practitioners in Saudi Arabia have high compliance to infection control ( $x=3.45$ ,  $SD \pm 0.28$ ) and very high compliance to contact precaution ( $x=3.45$ ,  $SD \pm 0.82$ ) practices during the time of coronavirus pandemic. The author concluded that healthcare practitioners in Saudi Arabia usually comply to infection control practices and always comply to contact precaution. Also, health workers' infection control and contact precaution practices across Najran, Al Baha, Riyadh and Abha are the same and standardized.

Mehmet et al., tried to understand roles of systemic disorders in pathophysiology of rheumatic heart disease (RHD). They detected 29 females and 20 males with RHD. Their mean ages were 42.7 versus 33.0 years, respectively ( $p=0.016$ ). the author concluded that systemic disorders including SCDs, RA, SLE, and JRA induce chronic inflammatory processes on vascular endothelium in whole body, and terminate with an immunosuppression by several mechanisms that may be the cause of higher prevalence of RHD together with such disorders.

Mehmet et al., tried to understand possible effects of thalassemia minors (TM) plus iron deficiency anemia (IDA) on weight, height, and body mass index (BMI). Cn this field, TM and IDA must be researched separately to be able to understand the effects of low Hct values and/or iron deficiency with increased number of cases. Similarly, effects of higher BMI and smoking on BP must be researched separately with further studies, too.

A paper from Iran looked at the quality of child birth in the North and South World through sociological appraisal. The North world countries that experienced socio-cultural change earlier, their demographic norms and values changed too. In that, women started giving birth to fewer children, followed by less maternal mortality and longer life expectancy for them. African countries where women give birth to 7-8 children, they usually remain at very high risk. Quality of children in the South world countries among others remains poor from nutritional and educational viewpoints. One of the risks of high pregnancy and child birth is associated with deaths of mothers.

# A Comparative Retrospective Study of Lipid Profile in Obese Type 2 Diabetics and Obese Non Diabetics in Aseer Region, K.S.A.

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## ABSTRACT

**Background:** There is an increase in the prevalence of obesity all over the world. It has become a serious problem as it leads to several other metabolic chronic disorders including Diabetes mellitus (DM), one of the major global pandemics nowadays. Obesity and DM are currently threatening health, well-being and welfare of humans. They have a close relationship, and type 2 diabetes mellitus (T2DM) is strongly associated with obesity. T2DM is a common disorder known to everybody, with a prevalence that usually rises with increasing degrees of obesity. Dyslipidemia is found high in patients with diabetes mellitus and obesity. There is increasing evidence that abnormal changes in the metabolism of lipids are amazingly very important risk factors of diabetes leading to many complications. The most important complications are lipid profile abnormalities which are a good indicator for risk (risk factor). Abnormalities in the serum lipid levels are most likely to participate to the increased risk of coronary artery diseases in patients with diabetes. The Aim of this study is to assess the correlation between serum lipid profile as a risk factor for cardiovascular disease with other biochemical/hormonal variables, anthropometric and clinical variables among obese diabetes mellitus and obese non-diabetic patients.

**Methods:** A comparative retrospective cross sectional study of obese type 2DM and obese non-diabetic patients was conducted at the Family Medicine Department, College of Medicine, King Khalid University, Abha, Saudi Arabia through data provided by the Medical Specialist Center in Abha city and Diabetes and endocrine Centre which belong to Khamis Mushait Military Hospital from March 2020 to May 2020. A total of 500 Saudi participants (200 obese Type 2 diabetic patients (T2DM) [Group I], 200 obese non-diabetic patients [Group II] and 100 healthy controls [Group III]) were randomly selected using systematic random sampling technique to assess the association of dyslipidemia and other biochemical/hormonal variables as risk factors in obese T2DM and obese non-diabetic patients. Fasting venous blood sample was collected. Patients were subjected to investigations of fasting blood sugar, glycosylated hemoglobin (HbA1c), fasting serum lipids profile, kidney function tests, liver enzymes, thyroid function tests and vitamin D level. Anthropometric and clinical variables among obese diabetes mellitus and obese non-diabetic patients were evaluated. Statistical analysis was carried out using standard deviation and chi-square from which 'p' value is derived. Independent sample t-test was used to compare means. P-value < 0.05 was considered statistically significant.

**Results:** In the obese diabetic patient group (GI) and obese non-diabetic patient group (GII), the mean total cholesterol levels, triglycerides levels, LDL-C levels were found to be [TC =210.45±43.12 mg/dl, 224.32±63.47], TG [192.48±85.46 mg/dl, 205.41±120.81] and LDL-C[115.46±40.13 mg/dl, 135.27±45.87] and this was significantly higher than in the controls (GIII) (P<0.01). However, the mean HDL-c value for GI & GII was found to be 58.79±18.93 mg/dl and 53.27±18.59 mg/dl. The HDL-c /LDL-c ratio was calculated in GI and GII and it was found to be (0.26 ± 0.05 & 0.53 ± 0.47 vs 0.56 ± 0.28) which was higher than those reported in the control group. A significant difference (P<0.0001) was found between patients and control population when the serum TC, TG, HDLc values, LDLc values, HDLc /LDLc ratio were compared to them. No significant differences were observed between different age categories and gender along with both patient groups and controls. Evident correlation was observed between anthropometric measurements and the lipid profile in GI and GII.

**Conclusion:** The study has documented several lipid abnormalities in obese type 2 diabetes mellitus and obese non-diabetic patients and has pointed to the significance of diabetic management in the control of lipid abnormalities where the control of overweight and obesity is of utmost importance. That is why in the upcoming studies we will try to detect the pattern of eating in Saudi people in Aseer Region and its relation to obesity with its subsequent. DM patients as well as obese patients are more prone to dyslipidemia which is an important risk factor for atherosclerosis and coronary heart disease so they require special attention to proper eating, and hypolipidaemic drugs to avoid associated co-morbidity of diabetes mellitus. This can be done through health education at the primary care level and the diabetic clinics.

**Key words:** Type 2 Diabetes Mellitus; Obesity; Dyslipidemia; Lipid Profile; BMI (Body Mass Index)

## Introduction

Overweight and obesity are the main risk factor for diabetes that can be modified. Adults with obesity are many times more likely to develop diabetes mellitus than adults of a healthy weight. Currently 90% of adults with type 2 diabetes are overweight or obese (1). People with severe obesity are exposed to a high risk of developing type 2 diabetes than obese people with a lower BMI (2). There is a marked association between obesity and type 2 diabetes. The likelihood and severity of type 2 diabetes are linked with increased weight and body mass index (BMI). There is more than five times greater risk of diabetes in obese people compared to those of a healthy weight, with a threefold increase in risk for overweight people (3). It is well known that the body fat distribution is usually an important determinant of increased risk of diabetes; the precise mechanism of association remains unclear. It is really unclear why not everybody who is obese develops type 2 diabetes and why not all people with type 2 diabetes are obese (4,5). Everybody with overweight or obesity is more vulnerable to have type 2 diabetes. When BMI increases, the risk of developing type 2 diabetes increases (6).

The most important environmental risk factors in T2DM patients were high caloric intake, family history, decreased physical activity and stronger multiple genetic predisposition. Obese patients have an induced insulin resistance and the mechanism of this resistance is not well known. Inflammation may be the common mediator linking obesity to the pathogenesis of diabetes (7).

Once there is obesity, the first and foremost observable changes are impaired glucose tolerance and increased insulin resistance, which result in hyperinsulinemia. This may be resulting from a combination of multiple genetic predispositions and environmental factors, that causes deranged insulin secretion (8).

Dyslipidemia is usually associated with obesity and diabetes. An increased level of plasma free fatty acids, cholesterol and triglycerides leads to decreased levels of high-density lipoprotein (HDL), and altered low-density lipoprotein (LDL) which are associated with a higher risk of cardiovascular disease (9).

The metabolic effects of subcutaneous and intra-abdominal fat are different which may be due to differences in adipose tissue distribution. It is known that abdominal fat is considered to be most likely lipolytic than subcutaneous fat. It has an unusual role in producing insulin resistance leading to diabetes mellitus. The body fatty acid release is higher in obese subjects as compared to lean subjects because of their greater fat mass (10). One of the studies found that the association between enlargement of visceral adipocytes and dyslipidemia are independent of the body composition and the fat distribution in obese subjects (11). The data collected were similar to those seen in patients suffering from type 2 diabetes. Inflammatory molecules that are produced by a lot of adipose tissue including TNF- $\alpha$ , IL-6, IL-1, serum amyloid A (SAA) and adiponectin, also play an important role in the development of dyslipidemia (12).

The association of hyperglycemia with dyslipidemia affects the progression of coronary heart disease and thus increases the rate of mortality in diabetes mellitus patients. Aggressive management and control of increased lipid levels along with anti-diabetic treatment not only reduces the complications of type 2 diabetes mellitus but also reduces the mortality rate (13).

Obesity is a disorder of the body regulatory system characterized by accumulation of excess body fat. It is an abnormal growth of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both. Obese people are more likely to have high cholesterol levels; so this increases the risk of atherosclerosis (14). Obesity is important in the development of insulin resistance in metabolic

syndrome that links with coronary heart disease. T2DM patients with dyslipidemia and obesity have markedly increased risk of coronary heart disease than dyslipidemic non diabetic obese patients (15).

Vitamin D has its unique roles other than calcium homeostasis and bone metabolism as it has emerged linking the fat-soluble vitamin to obesity and T2DM. It appears to enhance insulin sensitivity through different mechanisms (16). The studies have found a strong link between vitamin D deficiency, obesity and metabolic syndrome. Many cross sectional and some prospective epidemiological studies have found that low serum 25(OH)D concentrations are associated with T2DM (17).

Vitamin D plays a major role in the pathogenesis and prevention of diabetes, as some evidence suggests (17). In addition, vitamin D deficiency is an independent predictor of the development of coronary artery disease in individuals with diabetes. Furthermore, another study has shown that vitamin D deficiency in diabetes may predict all causes of mortality (18).

The aim of this study was to assess the correlation between serum lipid profile as a risk factor for cardiovascular disease with other biochemical/hormonal variables, anthropometric and clinical variables among obese Type 2 diabetes mellitus and obese non-diabetic patients compared to healthy controls.

## Methods

A comparative retrospective cross sectional study of obese type 2DM and obese non-diabetic patients was conducted at the Family Medicine Department, College of Medicine, King Khalid University, Abha, Saudi Arabia through data provided by Medical Specialist Center in Abha city which is allocated for chronic disease in Abha city and receives patients looking for the management of their chronic and endocrine disorders, and Diabetes Centre of Khamis Mushait Military Hospital from March 2020 to May 2020. Abha and Khamis cities constitute the central capital of Aseer region and all the citizens from all Aseer districts are pooled to these two cities for specialized medical and non-medical issues.

A total of 500 Saudi participants were categorized as follows: (200 obese Type 2 diabetic patients (T2DM) [Group I], 200 obese non-diabetic patients [Group II] and 100 healthy controls [Group III]) were randomly selected using systematic random sampling technique from March 2020 to May 2020. The demographic clinical data and medical history were recorded. The Body mass index (BMI) was considered normal if it was below 25kg/m<sup>2</sup> and 30 kg/m<sup>2</sup> or greater was obese (19).

Fasting blood glucose, Glycosylated hemoglobin (HbA1c), and lipid profile were tested as well as other Biochemical findings such as: liver enzymes [Aspartate transaminase (AST), Alanine transaminase (ALT), alkaline phosphatase (ALP)], and kidney function tests. These biochemical findings were estimated with commercially available kits and run on AU480 Chemistry Analyzer, Beckman Coulter. Thyroid function test (Free T3, Free T4 and TSH) and vitamin D were also estimated through Access 2 immunoassay system, Beckman Coulter.

Serum lipids profile were done on a sample of blood after fasting for 14-16 hours. LDL-Cholesterol was estimated by using Friedewald formula (20)  $LDL\text{-Cholesterol} = Total\ Cholesterol - (HDL\ cholesterol + Triglycerides/5)$ .

The method used for determining the cholesterol and triglycerides levels in the laboratory was the enzymatic color method. Dyslipidemia was defined according to the American Association of Clinical Endocrinologists' guidelines (21). The study was approved by the ethical board of King Khalid University in March 2020. Inclusion and exclusion criteria were involved in this study and that included (22):

**Inclusion Criteria:** The obese patients have been diagnosed with diabetes mellitus (GI). Obese non-diabetic group (GII), All had BMI more than 30 kg/m<sup>2</sup>.

### Exclusion Criteria:

1. Diabetic patients with overt complications including neuropathy, nephropathy, retinopathy, and ischemic heart disease.
2. Patients with acute complications like diabetic keto-acidosis, non-ketosis hyperosmolar coma and hypoglycemia.
3. Patients with coexisting illness like chronic liver disease or hypothyroidism.
4. Patients on drug therapy like diuretics, steroids, oral contraceptives and beta blockers etc.

Preformat was filled in for each patient and a full history was also taken from them. The basic anthropometric measures including: height (mts), weight (kg) and BMI were obtained in all subjects.

### Statistical analysis:

Data entry and data analysis were done using SPSS version 24 (Statistical Package for Social Science). Data were presented as number, percentage, mean, standard deviation. Chi-square test and Fisher Exact test were used to compare between qualitative variables. Independent sample t-test was used to compare quantitative variables between groups. P-value was considered statistically significant when  $P < 0.05$ . Paired-T was used to compare between variables in the same group. ANOVA analysis was done to compare the mean of each parameter.

## Results

This study was conducted on 200 obese type 2 diabetes mellitus patients (T2DM, GI), 200 obese non-diabetic patients (GII) and 100 age matched controls (GIII). The demographic distribution of our study population was gathered including age, sex, systolic and diastolic blood pressure (BP) and Anthropometric measures including : height (cm), weight (Kgm) and Body Mass Index(BMI) of the study groups as shown in (Table 1 & 2), (Figure 1).

Lipid Profile evaluation revealed that the cholesterol levels were increased (n=154, 77.0 %) in obese T2DM patients (GI) and were increased also (n=122 , 61.0%) in obese non-diabetics (GII). The triglycerides were increased in (n=142, 71.0%)

obese T2DM patients and (n=108, 54.0%) of the obese non diabetics showed increased values. The LDL-C levels were increased in (n=140, 70.0 %) of obese patients with T2DM, where (n=122 , 61.0%) of the obese non diabetics had increased values. The HDL-C levels were decreased in (n=144, 72.0%) of obese T2DM; whereas only (n=92, 46.0%) of the obese non diabetics had decreased values as shown in Figure 2.

Overall, obese T2DM patients (GI) had significantly higher total cholesterol ( $224.32 \pm 63.47$  vs.  $165.42 \pm 43.12$  mg/dl), triglycerides levels ( $205.41 \pm 12.81$  vs.  $110.49 \pm 52.43$  mg/dl), low density lipoprotein ( $135.27 \pm 45.87$  vs.  $102.15 \pm 34.21$  mg/dl) and significant decline of high density lipoprotein cholesterol ( $35.27 \pm 2.59$  vs.  $62.71 \pm 14.89$  mg/dl) as compared to healthy controls, respectively. Along with the obese non-diabetic patients (GII), a significant difference was found between patients and control population when the serum total cholesterol, triglycerides, LDLc values and HDLc values were compared to them ( $210.45 \pm 43.12$  vs.  $165.42 \pm 43.12$  mg/dl,  $192.48 \pm 85.46$  vs.  $110.49 \pm 52.43$  mg/dl,  $115.46 \pm 40.13$  vs.  $102.15 \pm 34.21$  mg/dl and  $58.79 \pm 18.93$  vs.  $62.71 \pm 14.89$  mg/dl).

However, the HDLc /LDLc ratio was found to be lower in GI and GII than those reported in the controls ( $0.26 \pm 0.05$  &  $0.53 \pm 0.47$  vs  $0.56 \pm 0.28$ ).

The detailed anthropometric parameters: height in meters, weight in kilograms and body mass index (BMI) are shown in Table 2. Evident correlation was observed between anthropometric measures with lipid profile (Figures 3 & 4) (obese T2DM

(GI) : P value was  $<0.05$  [ $P= 0.048^*$ ,  $0.025^*$ ,  $0.003^{**}$ ,  $0.026^*$ ] regarding correlation of BMI to total cholesterol, Triglycerides, HDL-C and LDL-C respectively while in obese non-diabetic patients (II), P value was  $<0.05$  [ $P= 0.002^{**}$ ,  $0.019^*$ ,  $0.042^*$ ] regarding correlation of BMI to total cholesterol, Triglycerides and HDL-C respectively, while it was non-significant regarding LDL-C, P value was  $>0.05$  ( $P=0.108$ ).

The estimated levels of lipid profile in obese type 2 diabetes (GI) and obese non diabetic patients (GII) along with fasting blood sugars and HBA1c compared to the control group (GIII) are shown in Table 3. Regarding the fasting blood sugars, it was significantly higher in GI compared to GII and III ( $P<0.001^{**}$ ,  $P<0.000^{***}$  respectively). In both groups (II and III), the fasting blood sugar was within normal limits ( $P>0.05$ ).

Hemoglobin A1c (HBA1c) level showed highly significant increase in GI compared to GII and the control group (GIII); although it is noticed to be increased in GII to the upper border of normality it is still within normal.

There is no significant difference all over the three groups regarding the other biochemical variables including: serum creatinine level, liver enzymes: Aspartate transaminase (AST), Alanine transaminase (ALT), alkaline phosphatase (ALP) and Thyroid function tests (free T3, Free T4 and TSH)  $P>0.05$ . Regarding vitamin D estimation, it was found that there was negative significant correlation (highly significant decline) in vitamin D levels in GI and GII compared to the healthy control group (GIII) [ $P=0.002^{**}$ ,  $0.031^*$ ].

**Table 1: Descriptive clinical characteristic status of the study groups**

Group		Obese T2DM group (GI)	Obese non-DM group (GII)	Control group (GIII)	P value
Variable					
Age (Mean $\pm$ SD)		55.03 $\pm$ 16.21	39.53 $\pm$ 14.46	40.80 $\pm$ 6.89	$P > 0.05$ NS
Sex (N, %)	Male	81(40.5%)	75(37.5%)	39(39.0%)	$P > 0.05$ NS
	Female	119(59.5%)	125(62.5%)	61(61.0%)	
Systolic BP (Mean $\pm$ SD)		138.22 $\pm$ 19.12**	132.73 $\pm$ 13.50**	119.80 $\pm$ 7.70	$P<0.001$
Diastolic BP (Mean $\pm$ SD)		78.96 $\pm$ 12.88*	73.61 $\pm$ 9.13*	71.80 $\pm$ 2.43	$P<0.05$

\*SD = Standard deviation, T2DM= type 2 diabetes mellitus, BP=Blood pressure.  $P < 0.05$  = Significant. N.S.=Non-significant.

**Table 2: Anthropometric Parameters of the study groups**

Group Parameter	Obese T2DM group (GI)	Obese non-DM group (GII)	Control group (GIII)	P value
Height(m) (Mean $\pm$ SD)	159.83 $\pm$ 9.81	165.59 $\pm$ 10.04	160.32 $\pm$ 8.66	<i>P</i> >0.05
Weight (Kg) (Mean $\pm$ SD)	79.96 $\pm$ 16.21	98.47 $\pm$ 18.94	78.76 $\pm$ 12.89	<i>P</i> <0.01
BMI (Mean $\pm$ SD)	31.07 $\pm$ 6.38	37.33 $\pm$ 7.12	28.70 $\pm$ 3.58	<i>P</i> <0.01

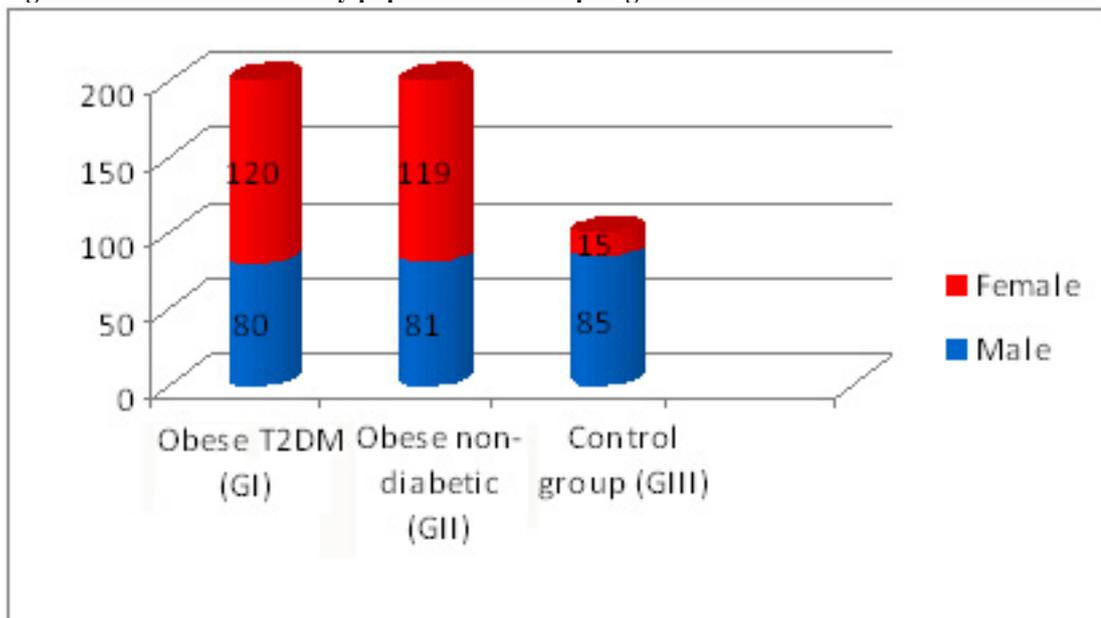
SD-Standard deviation, BMI – Body mass Index, T2DM – Type2 Diabetes Mellitus, *P* < 0.05 = Significant.

**Table 3: Lipid Profile, FBS and HBA1c in the Study Group**

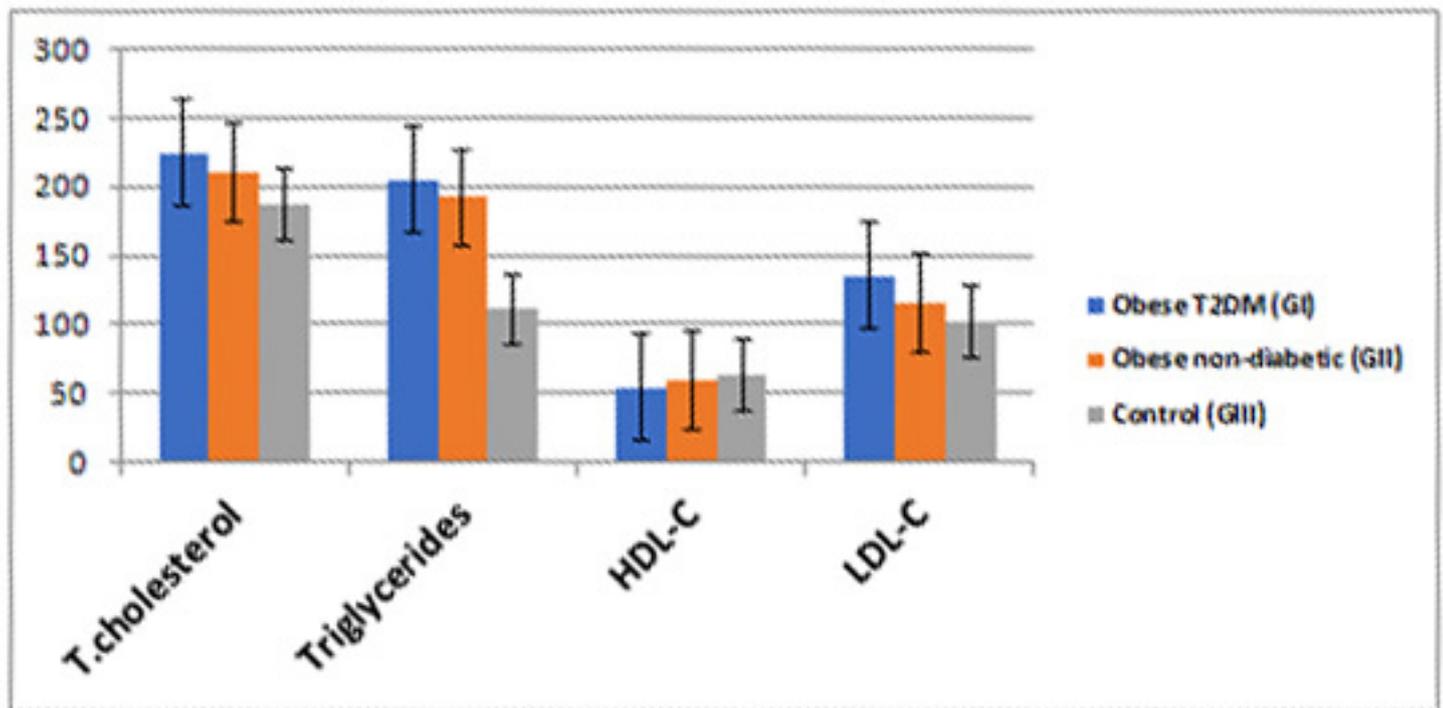
Group Parameter	Obese T2DM group (GI)	Obese non-diabetic group (GII)	Healthy control group (GIII)	P value
Cholesterol(mg/dl) (Mean $\pm$ SD)	224.32 $\pm$ 63.47	210.45 $\pm$ 43.12	165.42 $\pm$ 43.12	<i>P</i> <0.000***
Triglycerides(mg/dl) (Mean $\pm$ SD)	205.41 $\pm$ 12.81	192.48 $\pm$ 85.46	110.49 $\pm$ 52.43	<i>P</i> <0.000***
HDL-C(mg/dl) Mean $\pm$ SD	35.27 $\pm$ 2.59	58.79 $\pm$ 18.93	62.71 $\pm$ 14.89	<i>P</i> <0.02*
LDL-C(mg/dl) (Mean $\pm$ SD)	135.27 $\pm$ 45.87	115.46 $\pm$ 40.13	102.15 $\pm$ 34.21	<i>P</i> <0.001**
FBS (mg/dl) (Mean $\pm$ SD)	170.45 $\pm$ 12.79	135.29 $\pm$ 15.43	81.31 $\pm$ 8.45	<i>P</i> <0.000***
HBA1c (%) (Mean $\pm$ SD)	12.88 $\pm$ 56.91	5.63 $\pm$ 0.85	4.94 $\pm$ 0.68	<i>P</i> <0.05*

Obese T2DM= obese type 2 diabetes mellitus, SD= standard deviation, HDL-C=high density lipoprotein, LDL-C=low density lipoprotein, FBS=fasting blood sugar, HBA1c = Hemoglobin A1c, *P*<0.05= significant, NS=Non Significant, S = significant.

**Figure 1: Distribution of study population based upon gender**



**Figure 2: Distribution of study population: (Obese T2DM (GI), Obese non-diabetics (GII) and Control Group (GIII) based upon Serum Lipid Profiles level**



DM= Diabetes Mellitus HDL-C=high density lipoprotein, LDL-C=low density lipoprotein

Figure 3: Correlation between BMI and Cholesterol (A), Triglyceride (B), HDL-C (C) and LDL-C (D) in obese-T2DM group (Group I).

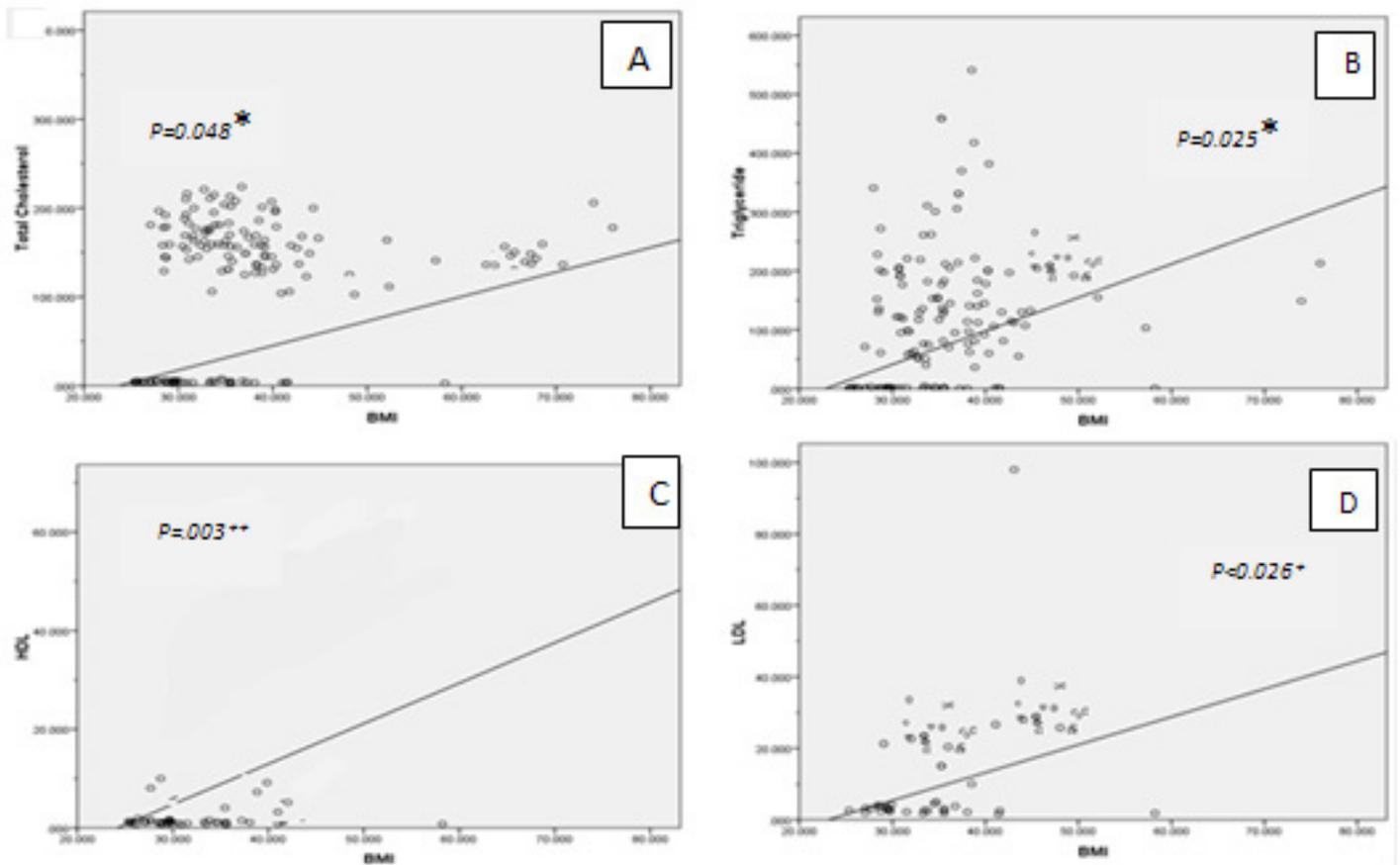
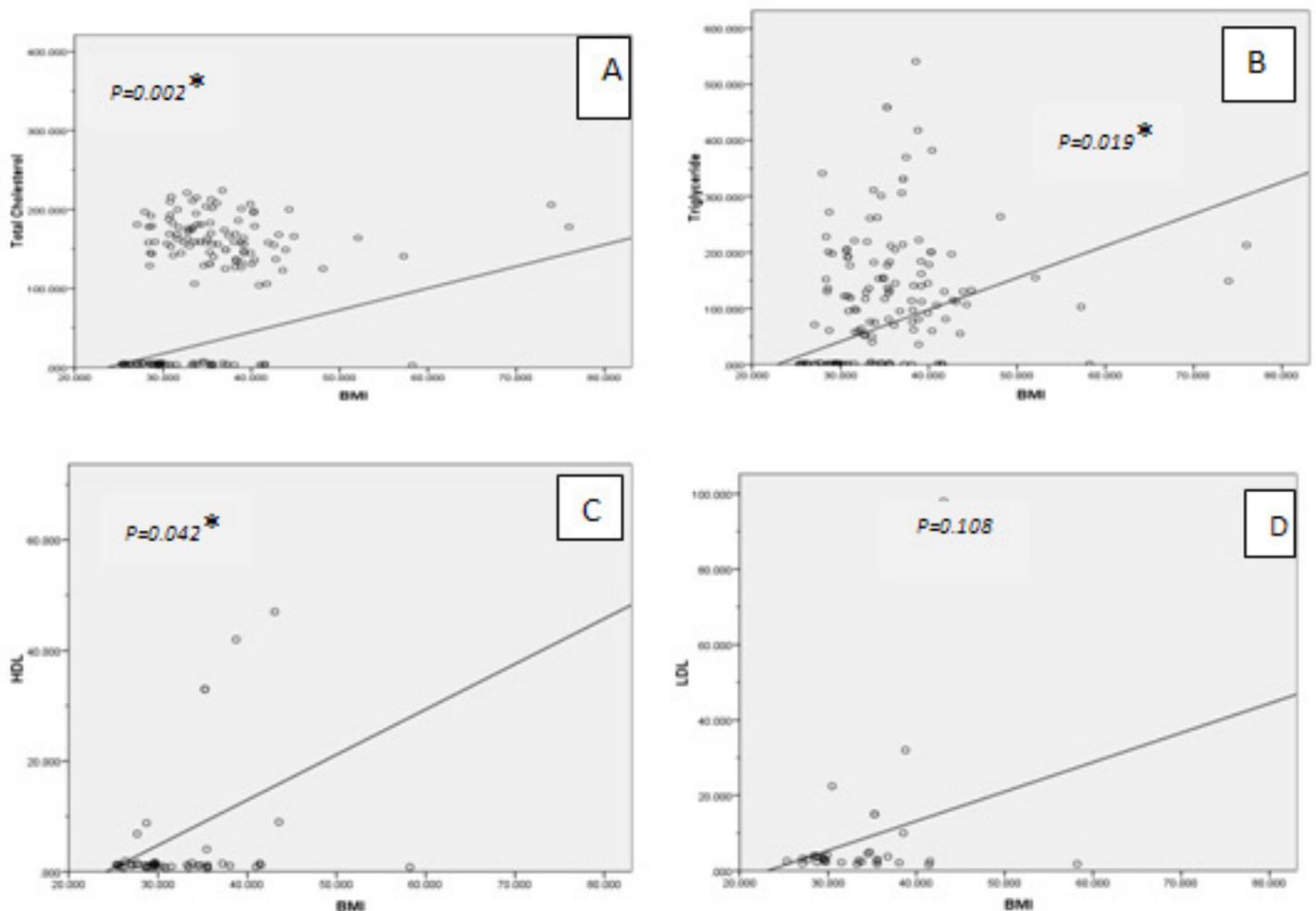


Figure 4: Correlation between BMI and Cholesterol (A), Triglyceride (B), HDL-C (C) and LDL-C (D) in obese non-diabetic patient group (Group II)



## Discussion

Diabetes and obesity are chronic metabolic disorders, which are greatly increasing all over the world. They are usually accompanied by many complications which mostly lead to morbidity. Body mass index has a strong relationship to diabetes and obesity.

In our study we were trying to figure out the link between overweight and obesity condition in obese diabetic patients and obese non-diabetic patients based on the serum lipids profile in the Saudi population in Aseer Region, KSA and we were planning to discover the best ways to deal with these serious conditions through controlling the events happening in the body of these patients.

In dyslipidemia in patients with diabetes there are hypertriglyceridemia and low levels of HDL-C (23). Hypertriglyceridemia increases the risk of developing life threatening complications like diabetic ketoacidosis, coronary artery disease and lipaemia retinalis (24). It is more common in diabetics as compared to non-diabetics due to a four fold increase in VLDL triglyceride (25).

Usually type 2 diabetes mellitus and obesity are accompanied by and increased in the deposition of triglycerides in non-adipose tissue, such as skeletal muscle, liver, heart and pancreas. To define obesity, it is fat accumulation in the subcutaneous abdominal and visceral depots, and is most strongly associated with the risk of metabolic and cardiovascular complications (26). Similar to our study, some studies conducted by Santen et al. and Peret et al. observed mean serum triglyceride levels much higher in obese diabetics in comparison to obese control subject (27&28). The relationship between obesity and T2DM is affecting anthropometric indices so that is supplying us with an effective screening and follow up for T2DM. However, the best index (BMI) for indicating the relationship between obesity and T2DM is unknown and the conclusions are not uniform (29).

Evident correlation was observed between anthropometric measures with lipid profile (obese T2DM (GI)) : P value was  $<0.05$  [ $P= 0.048^*, 0.025^*, 0.003^{**}, 0.026^*$ ] regarding correlation of BMI to total cholesterol, Triglycerides, HDL-C and LDL-C respectively while in obese non-diabetic patients (GII), P value was  $<0.05$  [ $P= 0.002^{**}, 0.019^*, 0.042^*$ ] regarding correlation of BMI to total cholesterol, Triglycerides and HDL-C respectively, while it was non-significant regarding LDL-C; P value was  $>0.05$  ( $P=0.108$ ). We observed that females in both GI and GII had much increased serum total cholesterol, triglycerides and LDL-c when compared to males participating in the same study. There was an increase in the level of HDL-c among females compared to males in our study and this is good evidence of the positive effect of estrogen in increasing HDL level, as was previously studied (30).

Cardiovascular disease associated with atherogenic dyslipidemia is the more increasing risk to be developed in patients with type 2 diabetes. This signifies individuals having diabetes and those with obesity are more susceptible to develop cardiovascular disease than control individuals. It has been

well documented that high levels of cholesterol and LDL play an important role in the development of arteriosclerosis and hence coronary artery disease (22). Dyslipidemia is one of the common associations in T2DM as well as in obese non diabetics and the reported prevalence of dyslipidaemia varied from 25 to 60% (31). Hypercholesterolemia and hypertriglyceridemia, High LDL-C, Low HDL-C and low HDL-C/LDL-C ratio were highly significant in this study in both obese diabetic and obese non-diabetic groups compared to the control group [ $P<0.001$ ,  $P<0.01$ ,  $P<0.05$ ,  $P<0.001$ ]. These values did not differ significantly from the obese non diabetic patient group (GII) [ $P>0.05$ ].

This is consistent with the study of Jain Darshna, et al who showed that hypertriglyceridemia predisposes the patients to life threatening complications like diabetic ketoacidosis, coronary artery disease and lipaemia retinalis (26). In the study of Gambhir et al, there was low HDL-C which was considered as an independent risk factor for occurrence of premature coronary artery disease (28). Many studies have strongly suggested an inverse correlation of HDL-cholesterol level with the development of ischemic heart disease (29).

Similar studies of D Sharma and A Jain observed increase in the levels of serum total lipids, total cholesterol, serum triglycerides and serum phospholipids in diabetic subjects as compared to normal controls (32). While Yadav NK et al observed Serum HDL – cholesterol levels did not differ significantly ( $P >0.05$ ) in the two study groups but levels were low in obese diabetics compare to obese controls (33).

Genetic or acquired hypercholesterolemia is considered as an independent CHD risk factor. It is estimated that of most of the total heart diseases, about 56% may be caused by hypercholesterolemia ( $>200$  mg/dl) alone (34).

Our study showed that there was no apparent sex variation in the prevalence of increased lipid profile regarding obese T2DM as well as obese non-diabetic patients group; with only a slight increase in the female group. A study by Nalchjavani and other authors found that all types of dyslipidemia were significantly more prevalent in females (35).

Modern therapy of patients with diabetes demands that the physician aggressively treats lipids to reduce the high risk of cardiovascular disease in this susceptible population and in those with very high triglycerides to reduce the risk of pancreatitis (36&37).

In the current study, increased TG concentrations are consistently accompanied by low HDL concentrations that often coexist with the elevated plasma glucose levels. This is in agreement with Shabana et al, who found that a high amount of sugar in plasma (hyperglycemia) results in the transfer of cholesterol esters from HDL-C to VLDL particles (38).

Apparently healthy individuals should get their lipid profiling done once or twice a year and go for appropriate lifestyle changes so as to prevent the onset of metabolic aberrations (39).

## Conclusion

In this study we reported that obese type 2 diabetes mellitus patients and obese non-diabetic patients have almost similar serum lipid profile levels. The prevalence of both obesity and type 2 diabetes continues to rise in Aseer region, KSA, along with associated direct patient care costs and wider costs to society. The purpose of this study is to describe the relationship between obesity and type 2 diabetes based on lipid profile and BMI and not to review treatment options and setting plans for further studies. Those groups of patients have well established risk factors for cardiovascular diseases. Realizing that most of the diabetics and obese have a high probability of developing cardiovascular and cerebrovascular disease, it is essential that in an individual who is obese and diabetic (two strong risk factors for coronary artery disease) their dyslipidemia should be properly taken care of, to reduce morbidity and mortality in diabetics.

Despite the small number of studies included, this study provided crucial insights into intervention strategies to address the emerging pandemic of obesity and T2DM among Saudi adults though more elaborate studies with increased sample size may provide more insights.

Other clinical studies worked at reducing the bad effects of these conditions; have been conducted or are undergoing trials. Detailed exploration of the metabolic and molecular basis of the disease may guide new approaches to prevent and treat these conditions since genetic predisposition plays an important role in the pathogenesis of insulin resistance.

## Declaration of conflicting interests:

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

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# Clinical pattern of inflammatory bowel disease in Southern Saudi Arabia: a retrospective cohort study

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## ABSTRACT

**Background & Study Aim:** Inflammatory bowel disease (IBD) is characterized by chronic inflammation of the gastrointestinal tract, caused by a dysregulated immune response to the host intestinal microflora. The main types of IBD are ulcerative colitis (UC) and Crohn's disease (CD). Ulcerative colitis causes long-lasting inflammation and ulceration in the innermost linings of the large intestine (colon) and rectum, while Crohn's disease is characterized by inflammation of the lining of the digestive tract. The present study was conducted to assess magnitude, epidemiological pattern, and complications of IBD in Aseer region of Southern Saudi Arabia.

**Patients & Methods:** A retrospective study targeting patient records of all patients with IBD, who were diagnosed with CD and UC over the period between 1980 and 2019 at gastroenterology unit, Aseer central hospital. The data were extracted from the patients' files covering the demographic data, signs and symptoms at the onset of disease, laboratory data, radiological findings, and endoscopic findings.

**Results:** The study included 134 patients, of whom 68 (50.7%) were diagnosed with ulcerative colitis (UC) and 66 (49.3%) with Crohn's disease (CD). Considering the endoscopic findings, the CD patients have maximum site of lesion at terminal ileum, followed by the descending and sigmoid colon. Whereas in UC patients the most recorded endoscopic site affected was the descending colon followed by sigmoid colon, and then transverse colon. Anemia was the most frequent complication affecting both groups of patients.

**Conclusion:** IBD is no longer an uncommon ailment in KSA. UC is in a sound state, while CD is escalating considerably and far outnumbering UC.

**Key words:** Inflammatory bowel diseases (IBD), ulcerative colitis (UC), Crohn's disease (CD), Computed Tomography (CT), Magnetic Resonance Imaging (MRI)

## Introduction

Inflammatory bowel disease (IBD) is a chronic inflammatory disorder affecting gastrointestinal (GI) tract, mainly small and large intestine. There are two major types of IBD: Crohn's disease (CD) and ulcerative colitis (UC). However, there is a small group (10%) of patients who are not classified as having either CD or UC; those are categorized as intermediate colitis(1, 2). The exact cause of IBD is unknown but there are many current hypotheses implicating a combination of genetic, environmental and immunoregulatory factors in pathogenesis of IBD (1, 3). The infectious microbes, ethnic origin, genetic susceptibility, and a dysregulated immune system can result in mucosal inflammation. The incidence and prevalence of IBD are higher in the northern part of the world such as Europe and Canada. However, recent studies have reported an increase in the incidence and prevalence of IBD in the Middle East and Gulf countries which were previously known to have low incidence and prevalence (4, 5, 6). A few reports from Saudi Arabia, mainly from Riyadh, have shown an increase of the incidence and prevalence of IBD (7, 8, 9). This increase has been attributed to the westernization of the lifestyle and improvement in sanitization (10).

Both CD and UC are commonly diagnosed before the age of 30 years, although a small group is detected at an older age between 50s and 60s(11). CD usually affects any part of the gastro-intestinal tract from mouth to anus. Smoking has been reported to reduce the risk of UC, but in contrast, increases the risk for CD. Furthermore, previous reports documented a slight gender difference as CD has been reported to be higher in women, whereas UC is reported to be higher in the male population (9, 12).

CD and UC are chronic, relapsing diseases in which symptoms vary from patient to patient and may range from mild to severe in intensity. The commonly experienced symptoms are dysentery, abdominal pain, weight loss, and arthralgia (9, 10, 11). Once IBD has been diagnosed, the symptoms can often be effectively managed. However, CD and UC are chronic illness where disease may recur and complications may flare up.

The aim of this study was to estimate the prevalence of IBD in Aseer region and to study the demographic, clinical pattern, and course of the disease in terms of therapeutic management with medications and surgical interventions.

## Patients and Methods

This is a retrospective record based study targeting all records of 134 patients with IBD, who were diagnosed with either CD or UC over a period from 1980 to 2019 at the gastroenterology unit, Asser central hospital (ACH), Abha, Saudi Arabia. This is the main tertiary hospital in Aseer region, southern part of Saudi Arabia, serving more than two million people. The hospital has a total clinical capacity of 574 beds, and contains the latest modern medical devices and technologies that rarely present in most of the hospitals in some of the developed countries. The data were extracted with the help of specially designed data collection tools to minimize extraction errors. The data extracted covered the demographic details of the patients, signs and symptoms at the onset of the disease, date of onset, time interval between the disease onset and the time of diagnosis, laboratory, and radiological and endoscopic findings. The present study was approved by the Ethics Committee of Aseer Central hospital.

## Statistical analysis

The data were extracted, revised, coded and fed into statistical software IBM SPSS version 22. All statistical analysis was performed using two tailed tests and alpha error of 0.05 and P value less than or equal to 0.05 was considered to be statistically significant. Descriptive analysis is based on frequency and percent distribution for all patients' demographics, clinical data, radiological and endoscopic findings.

## Results

### Epidemiology of patients with IBD

The study included 134 patients of whom 68 (50.7%) were diagnosed with ulcerative colitis (UC) and 66 (49.3%) with Crohn's disease (CD). For patients with Crohn's disease, 65.2% were below the age of 30 years and 66.7% were men. A total 15.2% overweight patients were recorded and 89.4% of them had the disease for 9 years or less. Regarding ulcerative colitis, 45.6% were aged less than 30 years, and 54.4% were men. Obesity was recorded among 11.8% of the cases and 86.8% had the disease for 9 years or less (Table 1).

### Clinical presentation of patients with IBD

Table (2) demonstrates the clinical presentation of the study population. The most recorded physical signs among CD cases were abdominal tenderness (36.4%) followed by skin lesion (21.2%), and pallor (18.2%). On the other hand, the frequency of the same physical signs among patients with UC was 33.8%, 29.4%, and 25% respectively.

Considering symptoms, the most reported symptoms by patients with CD were abdominal pain (87.9%), followed by weight loss (47%), and bloody diarrhea (42.4%), while the frequency of these symptoms reported by UC patients were: 75%, 64.7%, and 33.8% respectively.

### Radiological findings

According to radiological findings, the most frequent affected sites detected by CT in CD cases were: ileum (67.4%), sigmoid colon (37.2%), ileocecal (30.2%), and jejunum (25.6%). In contrast, in UC, the lesions were seen in sigmoid colon (72.2%), descending colon (66.7%), transverse colon (55.6%), and ascending colon (27.8%). Specific CT pathological findings reported among CD cases was wall thickening which was found in the majority of the cases (84.6%). This was followed by wall enhancement (15.4%), and abscess formation (12.8%). However, in UC, the reported corresponding CT findings were 80%, 20%, and 13.3% respectively. MRI was done in only 25 patients who showed that the most affected site of lesion among patients with CD were: rectum (40%), anus (26.7%), and then sigmoid colon (26.7%). While in UC, all lesions detected with MRI were confined to the rectum. Details of MRI pathological findings in CD patients included wall thickening (62.5%), wall enhancement (37.5%), and perianal fistula (25%). However, the frequencies of these abnormal MRI findings in UC patients were evenly distributed at 50%.

### Disease behavior and extent of the disease

The endoscopic findings are shown in Table 3. It is clear that terminal ileum was the main site affected (41.2%) among CD cases. Other affected sites were the descending, sigmoid colon (35.3% for each), and the ileocecal valve (31.4%). It was alarming that the majority of patients with UC (69.65%) had pan-colitis, while 21.4 % had proctitis, and 8.9% had left sided colitis.

## Medical management

As shown in Table 4, the majority of patients with CD (70%) received Azathioprine in addition to biological therapy and calcium supplement in 50% of them, while 43.3% received corticosteroids. The corresponding percentages in patients with UC were 59.7% for both Azathioprine and Amino Salicylates, 64.5% for calcium supplements, and 50% for steroids.

## Complication of the disease

The spectrum of complications (Table 5) was as follows: anemia (58.1%) among patients with CD and 79.2% of UC patients. Moreover, 35.5% of UC patients had toxic mega colon and 32.3% of CD patients had intestinal obstruction.

**Table 1: Personal characteristics of patients with inflammatory bowel diseases in Aseer Central Hospital**

Personal data	Diagnosis			
	Crohn's Disease (n=66)		Ulcerative colitis (n=68)	
	No	%	No	%
<b>Age (in years)</b>				
< 30 years	43	65.2%	31	45.6%
30-39	14	21.2%	17	25.0%
40+	9	13.6%	20	29.4%
<b>Sex</b>				
Male	44	66.7%	37	54.4%
Female	22	33.3%	31	45.6%
<b>Body mass index</b>				
Normal	56	84.8%	60	88.2%
Overweight/ obese	10	15.2%	8	11.8%
<b>Disease duration (in years)</b>				
1-4	20	30.3%	14	20.6%
5-9	39	59.1%	45	66.2%
10+	7	10.6%	9	13.2%

**Table 2: Clinical presentation of cases of IBD in Aseer Central Hospital**

Clinical presentation	Diagnosis				
	Crohn's Disease		Ulcerative colitis		
	No	%	No	%	
<b>Physical sign at initial presentation</b>	Aphthous ulcer	1	1.5%	1	1.5%
	Abdominal tenderness	24	36.4%	23	33.8%
	Abdominal mass	6	9.1%	6	8.8%
	Eye signs	8	12.1%	4	5.9%
	Skin lesion	14	21.2%	20	29.4%
	Pallor	12	18.2%	17	25.0%
	Other	10	15.2%	2	2.9%
<b>Symptoms</b>	Abdominal pain	58	87.9%	51	75.0%
	Bloody diarrhea	28	42.4%	44	64.7%
	Rectal bleeding	7	10.6%	11	16.2%
	Weight loss	31	47.0%	23	33.8%
	Constipation	12	18.2%	1	1.5%
	Tenesmus	3	4.5%	6	8.8%
	Fever	13	19.7%	1	1.5%
	Joint pain	3	4.5%	5	7.4%
	Mouth ulcer	5	7.6%	0	0.0%
	Nausea/vomiting	13	19.7%	4	5.9%
	Other	3	4.5%	4	5.9%

Table 3: Endoscopic clinical findings for cases of IBD in Aseer Central Hospital

Endoscopy findings	Crohn's Disease		Ulcerative colitis	
	No	%	No	%
Terminal Ileum	21	41.2%	4	7.1%
Ileocecal valve	16	31.4%	4	7.1%
Cecum	10	19.6%	12	21.4%
Ascending colon	13	25.5%	25	44.6%
Transverse colon	13	25.5%	38	67.9%
Descending colon	18	35.3%	41	73.2%
Sigmoid	18	35.3%	40	71.4%
Rectum	14	27.5%	33	58.9%
Anus	13	25.5%	9	16.1%

Table 4: Treatment received by cases of IBD in Aseer Central Hospital

Treatment received	Diagnosis			
	Crohn's Disease		Ulcerative colitis	
	No	%	No	%
Steroid	26	43.3%	31	50.0%
Azathioprine (Imuran)	42	70.0%	37	59.7%
Aminosalicylates (5-ASA)	22	36.7%	37	59.7%
Metronidazole	1	1.7%	2	3.2%
Ciprofloxacin	3	5.0%	1	1.6%
Methotrexate (MTX)	1	1.7%	2	3.2%
Biological therapy	30	50.0%	23	37.1%
Iron supplements	9	15.0%	12	19.4%
Calcium supplement	30	50.0%	40	64.5%

Table 5: Complications recorded among cases of IBD in Aseer Central Hospital

Complications	Diagnosis			
	Crohn's Disease		Ulcerative colitis	
	No	%	No	%
Anemia	18	58.1%	19	79.2%
Intestinal obstruction	10	32.3%	1	4.2%
Sepsis	4	12.9%	0	0.0%
Toxic mega colon	11	35.5%	2	8.3%
Stricture	1	3.2%	0	0.0%
Colon ca	0	0.0%	2	8.3%
PSC	0	0.0%	1	4.2%
Fulminant colitis	2	6.5%	1	4.2%
Bowel perforation	0	0.0%	0	0.0%
Small bowel bacterial overgrowth	2	6.5%	0	0.0%
Osteoporosis	0	0.0%	2	8.3%
DVT or PE	3	9.7%	1	4.2%

## Discussion

In this study we have tried to present the first hospital-based study that evaluates the prevalence and clinical pattern of IBD in the southern region of Saudi Arabia. IBD is now considered as a global healthcare issue with increasing incidence and prevalence rate in the last 20 years (13). It is our belief that the incidence of IBD is increasing in the Middle East including Saudi Arabia, due to westernization of the lifestyle with regard to eating and living habits (12, 14-16). The first reported incidence of IBD in Saudi Arabia was published in 1982 by Mokhtar and Khan estimating the incidence of CD as very low at 0.32/100,000 population (17). This low incidence was supported by El-Mouzan et al. in 2014 who reported that the prevalence of CD in Saudi Arabia in children younger than 14 to be only 0.27/100,000 population (18). Furthermore, a recent review by Taghreed reported that the incidence and prevalence of IBD in Saudi Arabia is increasing but an accurate estimate is lacking due to the limited studies in this condition (19). In our study, the ratio of patients diagnosed with UC to those diagnosed with CD was approximately 1:1, which is in contrast to the results observed from other countries, where UC was much more common than CD (20-24). This new observation has been supported by earlier studies which indicated that CD incidence is on the rise in Saudi Arabia due to the great changes in eating habits and a life style mimicking that of western countries (25, 26).

It is worth mentioning, that we found a male dominance in both patients with UC and patients with CD, in contrast to the equal sex distribution reported from other areas of Saudi Arabia and from some Asian countries (20, 21). On the other hand, IBD may occur at any age, mostly between 15-30 years; the majority of our patients with CD were younger than 30 years, in agreement with other studies from Saudi Arabia and Asian countries (19, 20, 21).

In our study, the most common clinical presentation reported in patients was abdominal pain followed by weight loss and dysentery which is consistent with what has been reported from other countries (19, 20, 24, 25). However, at the time of presentation, pan colitis was seen in most patients (69%) with UC, while, as expected the terminal ileum was the main site affected (41%) in CD patients. This finding is different from what has been reported from western countries where about 45% of patients with UC presented with proctosigmoiditis while the small and large bowel involvements were reported in 42% of patients (26-28).

Considering the therapeutic management, most of the patients with CD received Azathioprine; 43% patients received steroid at some point of their disease course, and 50% received anti-tumor necrosis factor (ANF). However, it is well acknowledged that such issues embrace a personalized approach based not only on disease extent and severity, but also on an individual patient's projected natural history of the disease. It is heartening that about half of our patients received biological therapies based on severity of the disease as recommended by recent guidelines which recommend newer biological therapies such as Tofacitinib, which seems to be most effective in patients who don't respond to infliximab, although vedolizumab may be considered as a reasonable alternative (29-31).

So, finally we can conclude that the ratio of patients diagnosed with UC to those diagnosed with CD was approximately 1:1; IBD may occur at any age, mostly between 15-30 years; the majority of patients with CD were younger than 30 years.

### Study Limitations:

Certain limitations to this study include the retrospective nature and the difficulty of tracing and follow up of patients to ascertain the rates of remission and mucosal healing.

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# Awareness of Colorectal Cancer and Attitude Toward Screening Among the Public in the Aseer region, Saudi Arabia

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## ABSTRACT

**Purpose:** This study assessed population awareness of colorectal cancer and the attitude toward screening and its determinants in the Aseer region of Saudi Arabia.

**Patients and methods:** A descriptive cross-sectional approach was used to identify all accessible populations in the Aseer region of southern Saudi Arabia. Data were collected from participants using an online pre-structured questionnaire. The tool assessed participants' biodemographic data, medical and family history, awareness regarding colorectal cancer and attitude toward screening.

**Results:** A total of 1,296 respondents completed the survey. Participants' ages ranged from 18 to 65 years, with a mean age of 29.6±13.8 years. The majority of participants were female (66.7%; 864). A total of 1,018 (78.5%) of the participants had heard about colorectal cancer, and 648 (50%) correctly defined it as large intestine cancer. Regarding symptoms, participants mostly reported abdominal pain (80.3%), blood in the stool (77.2%), and a change in bowel habits (76.7%). A good awareness level was established in nearly one-fifth of the participants.

A total of 1,236 participants (95.4%) reported that they would undergo screening if they had any risk factor for colorectal cancer. The main barrier to undergo screening was that participants did not have any symptoms (31.7%).

**Conclusion:** This survey revealed that the public awareness of colorectal cancer in the Aseer region was overall poor. Participants had some knowledge regarding individual aspects but lacked knowledge of others. We recommend that healthcare staff should pay more attention to improving public awareness of the recommended screening for colorectal cancer.

**Key words:** Awareness; Cancer of the colon; Colonoscopy; Intestine large; Occult blood; Population health; Preventive health care; Risk factors

## Introduction

Colorectal cancer (CRC) is the third most common cancer worldwide and the second leading cause of cancer deaths in the United States(1,2). There is considerable variation in CRC incidence internationally, with the rates registered in Asia, Africa, and South America being lower than those in North America, Oceania, and Europe, where the CRC risk factors obesity, diabetes, poor diet, physical inactivity, and smoking are more common (3,4).

In Saudi Arabia, the cancer mortality statistics show a significant upward trend in recent years (5). According to the Saudi Cancer Registry (SCR), colorectal cancer was the most common cancer among the male population and the third most common cancer among the female population (6).

CRC has numerous risk factors, of which the most important are obesity, a sedentary lifestyle, smoking, excessive consumption of alcohol and red meat, a low-fiber and high-fat diet, a positive family history, and age > 50 years(7–10). CRC can be asymptomatic for long or present with different symptoms, such as changes in bowel habits, chronic abdominal pain, gastrointestinal tract bleeding, fever, unexplained weight loss, malaise, and fatigue. Furthermore, some chronic conditions, such as inflammatory bowel disease, irritable bowel syndrome, infection, or hemorrhoids, may predispose patients to colorectal cancer (11–13).

Public awareness and knowledge are determinants of health behavior change, along with changes in the environment that give rise to them(14). Increasing the public awareness of CRC will help to improve peoples' health behaviors, including their willingness to undergo screening for cancer and related disorders, enabling early diagnosis and the lowering of the cancer-related burden in the population. Heightened awareness will help to reduce preventable risk factors through lifestyle modification, which will reflect good community health.

The current survey aimed to assess public awareness of CRC and the attitude toward screening and its determinants in the Aseer region of southern Saudi Arabia.

## Material and Methods

A descriptive cross-sectional approach was used to identify all accessible populations in the Aseer region of southern Saudi Arabia.

We constructed a survey tool after an intensive literature review and expert consultation. The tool was reviewed by a panel of three experts for content validity. Tool reliability was assessed using a pilot study of 25 participants with a reliability coefficient ( $\alpha$ -Cronbach's) of 0.76. The tool covered the following data: participants' biodemographic data, such as age, gender, place of residence, education, profession, and participants' family history of CRC and practice regarding screening for CRC. Awareness was assessed using ten questions covering the definition, signs, and symptoms of CRC, and the diagnostic methods and importance of screening for CRC. The tool was presented as an electronic pre-structured online questionnaire. We obtained approval from the Research Ethics Commit-

tee, Deanship of Scientific Research, King Khalid University (HAPO-06-B-001) on 05 June 2020, approval no. ECM#2020-0705. Consent was obtained from the study participants prior to study commencement. Persons aged 18 years or older in the Aseer region were invited to participate in the survey. All social media platforms were used to distribute the electronic questionnaire during the period from 1st April until 30th June 2020.

## Data analysis

Each correct answer to an awareness question counted as one point, and the total sum of the discrete scores of the different items was calculated. We defined a score of less than 60% (14 points) of the maximum score, as poor awareness. Good awareness was defined as a score of more than 60% (15 points) of the maximum score. Descriptive analysis based on frequency and percent distribution was performed for all variables, including biodemographic data, awareness items, and participants' attitude toward screening. Cross tabulation was used to assess the level of awareness compared to participants' personal and medical data. Relations were tested using Pearson's chi-square test.

After data were extracted from the survey, they were reviewed, coded, and analyzed using SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, NY, US). All statistical analyses were performed using two-tailed tests. A P-value < 0.05 was considered to be statistically significant.

## Results

The online survey was distributed to 1,500 individuals, of whom 1,296 responded and completed the questionnaire, corresponding to a response rate of 86.4%. Participants' age ranged from 18 to 65 years with a mean age of 29.6 (standard deviation 13.8 years). The majority of participants were female (66.7%). A total of 992 (76.5%) were university graduates. A monthly income of less than 5000 SR was recorded among 854 (65.9%) respondents, while 87% were free of any chronic health problems. A total of 418 (32.3%) participants had genetic disorders, but only 6 (0.5%) had a family history of CRC (Table 1).

Table 2 shows participants' awareness of CRC. A total of 78.5% had heard about CRC, and 648 (50%) correctly defined it as large intestine cancer. Many participants knew the frequently described symptoms such as abdominal pain (80.3%), blood in the stool (77.2%), and change in bowel habits (76.7%). Regarding the risk factors for CRC, 79.2% of participants were familiar with inflammatory bowel disorder, 62.2% had a positive family history, and about half of them associated with smoking and a high-fat diet. More than half (55.4%) of participants agreed that CRC is treatable when diagnosed. As for screening methods, participants were most familiar with colonoscopy (92%), followed by computed tomography colonography (77.2%), and stool analysis (55.4%). The vast majority (94.1%) of participants indicated that screening is important for the early diagnosis of CRC. Overall, 20.4% of participants had a good awareness of CRC.

Table 3 illustrates the participants' attitude toward CRC screening. A majority (95.4%) reported that they would undergo screening if they had any risk factors for CRC. The main barriers to screening reported by the participants were that they did not have any symptoms (31.7%) and had not been thinking

about undergoing screening (18.7%). About 44% of the participants had no specific reason not to participate in screening.

Regarding the sources of information on CRC, Figure 1 shows that these were mostly the internet and books (34%), followed by social media (27.3%) and study (26.7%).

Table 4 shows the level of awareness of CRC compared to participants' biodemographic data and source of information. Good awareness was more common among those aged under 30 years (24.3%) than in those above 50 (10.7%), and this difference was statistically significant ( $P = .001$ ). Also, 27.3% of males had good awareness compared to 16.9% of females ( $P$

$= .001$ ). Good awareness was more frequent among those who lived in urban areas (23.4%) compared to 15.2% of rural residents ( $P = .001$ ). With regard to occupation, 45.5% of healthcare workers had good awareness levels compared to 11.1% of non-healthcare workers ( $P = .001$ ). Among those with a family history of genetic disorders, 25.8% had good awareness compared to 17.8% of others ( $P = .001$ ), and good awareness was significantly more frequent among those ready to undergo screening for CRC than in those who were not ( $P = .041$ ). Good awareness was highest (45.7%) in those who had their information from study, compared to 32.1% of those who had it from doctors, and 4% of those who had no source of information ( $P = .001$ ).

**Table 1: Biodemographic data of participants (n = 1296) in survey on colorectal cancer awareness in the Aseer region, Saudi Arabia**

Biodemographic data	Participants		
	(n)	%	
Age (years)	<30	898	69.3 %
	30–39	186	14.4 %
	40–49	156	12.0 %
	>50	56	4.3 %
Gender	Male	432	33.3 %
	Female	864	66.7 %
Area of residence	Urban	822	63.4 %
	Rural	474	36.6 %
Marital status	Not married	862	66.5 %
	Married	434	33.5 %
Educational level	Primary school	14	1.1 %
	Secondary school	28	2.2 %
	High school	262	20.2 %
	University/ more	992	76.5 %
Occupation	Healthcare worker	154	11.9 %
	Non-healthcare worker	306	23.6 %
	Unemployed	836	64.5 %
Monthly income	<5000 SR	854	65.9 %
	5000–15000 SR	340	26.2 %
	>15000 SR	102	7.9 %
Do you have any chronic diseases?	No	1128	87.0 %
	Diabetes mellitus	30	2.3 %
	Hypertension	26	2.0 %
	Asthma	58	4.5 %
	Hypothyroidism	8	0.6 %
	Irritable bowel syndrome	10	0.8 %
	Colon cancer	13	1.0 %
	Crohn's disease/UC	4	0.3 %
	Others	19	1.5 %
Family history of any genetic disease	Yes	418	32.3 %
	No	878	67.7 %
Family history of colon cancer	Yes	6	0.5 %
	No	1290	99.5 %

(Abbreviations: SR, Saudi Riyal; UC, Ulcerative colitis)

Table 2: Awareness of colorectal cancer among survey participants (n = 1296) in the Aseer region, Saudi Arabia

Awareness		Participants (n)	%
<b>Heard about colorectal cancer before</b>	Yes	1018	78.5 %
	No	278	21.5 %
<b>What is colorectal cancer</b>	Stomach cancer	166	12.8 %
	Small intestine cancer	150	11.6 %
	Large intestine cancer	648	50.0 %
	Don't know	332	25.6 %
<b>Colorectal cancer is common</b>	Yes	520	40.1 %
	No	306	23.6 %
	Don't know	470	36.3 %
<b>Symptoms of colorectal cancer</b>	Abdominal pain	668	80.3 %
	Change in bowel habits	638	76.7 %
	Nausea and vomiting	384	46.2 %
	Yellowish skin or eyes	180	21.6 %
	Blood in stool	642	77.2 %
	Maybe asymptomatic	266	32.0 %
	Don't know	50	6.0 %
<b>Risk factors of colorectal cancer</b>	Old age	422	54.9 %
	Smoking	372	48.4 %
	Inflammatory bowel disease	608	79.2 %
	Positive family history	478	62.2 %
	High-fat diet	372	48.4 %
	Bowel polyps	334	43.5 %
	Don't know	44	5.7 %
<b>Colorectal cancer is treatable when diagnosed</b>	Yes	718	55.4 %
	No	20	1.5 %
	Don't know	558	43.1 %
<b>Time to screen for colorectal cancer</b>	When symptoms appear	562	43.4 %
	At age of 20 years	110	8.5 %
	At age of 50 years	212	16.4 %
	At age of 70 years	12	0.9 %
	Don't know	400	30.9 %
<b>Screening methods for colorectal cancer</b>	Stool analysis	320	55.4 %
	X-ray	98	17.0 %
	Colonoscopy	532	92.0 %
	CT colonography	446	77.2 %
	Ultrasound	78	13.5 %
<b>Early screening is important</b>	Don't know	40	6.9 %
	Yes	1184	91.4 %
	No	12	0.9 %
<b>Screening for colorectal cancer helps in early diagnosis and treatment</b>	Don't know	100	7.7 %
	Yes	1220	94.1 %
	No	10	0.8 %
<b>Overall awareness</b>	Don't know	66	5.1 %
	Poor	1032	79.6 %
	Good	264	20.4 %

**Table 3: Survey participants' (n = 1296) attitude toward colorectal screening, Aseer region, Saudi Arabia**

Practice items	Participants (n)	%
<b>Will you do the screening if you have any risk factor of colorectal cancer</b>		
Yes	1236	95.4 %
No	60	4.6 %
<b>Which of the following reasons prevent you from undergoing early screening for colorectal cancer</b>		
None	575	44.4 %
Don't have symptoms	411	31.7 %
Screening cost	172	13.3 %
Delay the screening	130	10.0 %
Colorectal cancer is not dangerous	12	0.9 %
Screening is not important	14	1.1 %
Didn't think about screening before	242	18.7 %
Not advised by doctor to do	80	6.2 %
Fear of the diagnosis colorectal cancer	180	13.9 %
Feel embarrassed and stressed	148	11.4 %
No doctor response	13	1.0 %
Family barriers	123	9.5 %

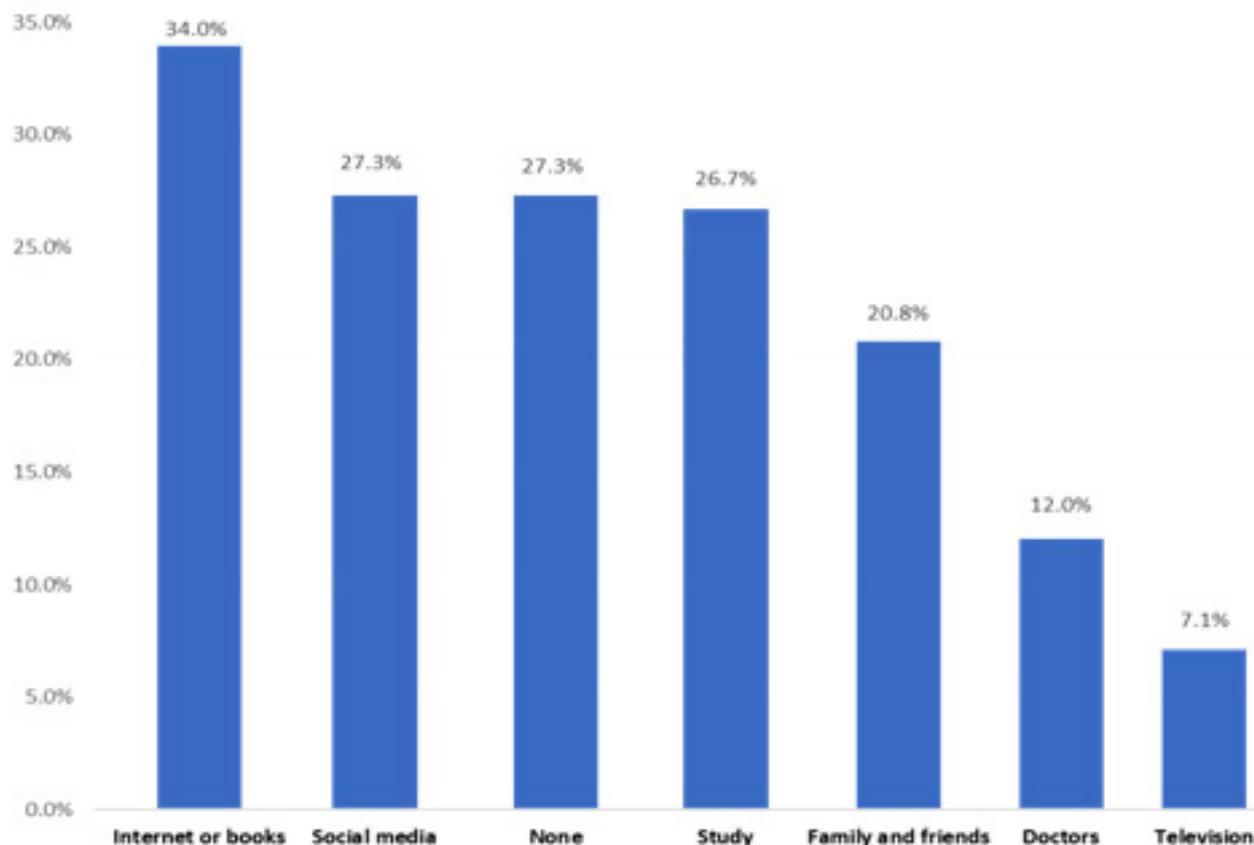
**Table 4: Survey participants' (n = 1296) level of awareness on colorectal cancer in relation to their biodemographic data and source of information**

Factors		Awareness level				P-value
		Poor		Good		
		No	%	No	%	
Age (years)	< 30	680	75.7%	218	24.3%	.001*
	30-39	162	87.1%	24	12.9%	
	40-49	140	89.7%	16	10.3%	
	> 50	50	89.3%	6	10.7%	
Gender	Male	314	72.7%	118	27.3%	.001*
	Female	718	83.1%	146	16.9%	
Residence	Urban area	630	76.6%	192	23.4%	.001*
	Rural area	402	84.8%	72	15.2%	
Educational level	Primary school	12	85.7%	2	14.3%	.023*
	Secondary school	26	92.9%	2	7.1%	
	High school	222	84.7%	40	15.3%	
	University/ more	772	77.8%	220	22.2%	
Job	Health care worker	84	54.5%	70	45.5%	.001*
	Non-Health care worker	272	88.9%	34	11.1%	
	Unemployed	676	80.9%	160	19.1%	
Chronic diseases	Yes	890	78.9%	238	21.1%	.091
	No	142	84.5%	26	15.5%	
Family history of any genetic disease	Yes	310	74.2%	108	25.8%	.001*
	No	722	82.2%	156	17.8%	
Will you undergo screening if you have risk factors of colorectal cancer?	Yes	978	79.1%	258	20.9%	.041*
	No	54	90.0%	6	10.0%	
Source of information on colorectal cancer	Family and friends	228	84.4%	42	15.6%	.001*
	Social media	272	76.8%	82	23.2%	
	Television	66	71.7%	26	28.3%	
	Doctors	106	67.9%	50	32.1%	
	Internet or books	320	72.7%	120	27.3%	
	Study	188	54.3%	158	45.7%	
	None	340	96.0%	14	4.0%	

P: Pearson's chi-square test

\* P < 0.05 (significant)

**Figure 1: Source of information on colorectal cancer among participants (n = 1296) in survey on awareness and knowledge on colorectal cancer, Aseer region, Saudi Arabia**



## Discussion

This survey aimed to assess the awareness of CRC in the general population of the Aseer region in Saudi Arabia. Furthermore, the survey established participants' attitudes regarding CRC screening and the factors influencing this attitude. The results show that only one-fifth of the participants (20.4%) were knowledgeable of CRC, but more than three-quarters had heard about CRC. Awareness was high for symptoms, particularly abdominal pain and change in bowel habits were well known, and the importance of screening and its role in successful treatment. Participants were also familiar with CRC risk factors, especially inflammatory bowel disease and a family history of CRC. About half of the participants knew that CRC is a treatable disease. Only 16% of participants knew the recommended age for starting screening, of 50 years.

One of the most interesting findings was that, while participants might be aware of individual items, their cumulative awareness was still poor. Participants were aware of some aspects of CRC but unaware of others. These results correspond to previous findings. In two other cross-sectional studies, screening awareness of CRC was more favorable (47.9% and 83.0%, respectively)(15,16). Besides, 22% of the participants reported the frequency of CRC correctly, 59% had acceptable information about the protocol, and 56.2% were informed about the development of CRC. In addition, 69.6% of the respondents reported the significance of early detection. Another report(17) showed a higher rate (78.5%) of participants who were informed about the frequency and protocol of CRC screening, which was likely

linked to a relatively high level of education. Gede et al(18) conducted a survey assessing the awareness of CRC, its screening, and the sources of information in the Hungarian population. They reported that 32.7% of the participants were correctly informed about the recommended age for the beginning of CRC screening and 22.4% about its frequency. In our study participants, young age, male gender, high education levels, being a healthcare worker, and a family history of CRC were the most significant predictors for good awareness.

Moreover, physicians and studies as a source of information were significantly related to higher awareness than other sources. However, the internet and social media were used by more than half of the participants, whereas physicians were the primary source of information only in 12% of participants. This indicates that the physician's role as a health educator is not well established in Saudi Arabia. These findings were concordant with an Italian report, where participants' sources of information were primarily friends, followed by television and newspapers, and only thereafter general practitioners and specialists (19).

In Kuwait, Saeed et al (20) investigated the level of knowledge and awareness of CRC with regard to risk factors, symptoms, and screening/imaging procedures among the general public. Overall, 75% of the participants had heard about CRC, and the most reported risk factors were genetics and a family history of CRC (73.5%). The most described symptoms were bloody stool, lower abdominal pain, obstructed intestine, and change in the nature of the exit, and the least common was anemia. Magnetic resonance imaging was identified as the most

frequent diagnostic procedure (36%), followed by computed tomography (31%). On the other hand, 27.7% of participants had only limited knowledge about the different diagnostic procedures. In Saudi Arabia, a survey-based study(21) in Makkah revealed that most of the participants (85.7%) had heard of CRC. However, nearly half of them had obtained their information as part of their school curriculum. More than half of the students knew that CRC might develop without any obvious symptoms. More than one-third (37.9%) of participants believed that men were more likely than women to suffer from CRC, while almost one-third (29.4%) said they knew nothing about the symptoms, and 21.8% thought that men and women have an equal chance of contracting CRC. The vast majority of participants (92.2%) had never undergone screening for tumors of the colon and rectum. Only 3.6% answered that they had undergone such screening. Another study(22) was conducted in Riyadh and revealed that most respondents believed that screening for CRC should begin with symptom onset (42.9%). Less than 20% of respondents believed that polyps were a risk factor for CRC, but the percentage varied significantly according to the level of education. However, even the most educated participants answered correctly less than 50% of the time. Similarly, only 34.8% of all respondents knew that a family history of CRC imparted a personal risk.

Among our participants, almost all (95%) had intended to undergo screening if they had any risk factor. The main reasons for eventually not doing that were that they did not have any symptoms, they feared and delayed the screening, and, finally, the cost of screening, as nearly 65% of the respondents were not employed and had a monthly income of less than 5000 SR (\$1,333).

## Conclusions

In conclusion, our survey revealed that public awareness of CRC in the Aseer region was poor overall, but each participant had some knowledge of individual aspects while lacking knowledge of others. Our results also show that nearly all participants were ready to undergo screening for CRC, but lacked knowledge regarding the recommended age for screening. The main barriers to screening were the absence of symptoms and risk factors, and the costs. We recommend that healthcare staff should pay more attention to improving public awareness of the recommended screening for chronic health problems, including CRC. This may happen in the form of short sessions of health education but should make use of posters, mass media, and social media, which were reported as the main source of information.

## Competing interest

The author reports no conflicts of interest in this work.

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# Effects of thalassemia minor plus iron deficiency anemia on weight, height, and body mass index

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## ABSTRACT

**Background:** We tried to understand possible effects of thalassemia minor (TM) plus iron deficiency anemia (IDA) on weight, height, and body mass index (BMI).

**Material and methods:** Cases with TM plus IDA with a hematocrit (Hct) value of lower than 30% were collected into the first, and age and sex-matched controls with a Hct value of 30% and greater were collected into the second group.

**Results:** The study included 89 patients (65 females) with TM plus IDA in the first, and 195 controls (143 females) in the second group, respectively. Their mean ages and female ratios were 35.7 versus 35.3 years and 73.0% versus 73.3%, respectively ( $p > 0.05$  for both). Mean Hct and mean corpuscular volume values were 23.2% versus 37.6% and 60.0 versus 81.1 fL, respectively ( $p = 0.000$  for both). Weight (63.3 versus 70.9 kg,  $p = 0.000$ ), height (161.2 versus 165.2 cm,  $p = 0.001$ ), BMI (24.4 versus 25.9 kg/m<sup>2</sup>,  $p = 0.007$ ), diastolic blood pressure (BP) (78.9 versus 86.8 mmHg,  $p = 0.000$ ), and smoking (8.9% versus 22.5%,  $p < 0.01$ ) were all lower in the first group, significantly.

**Conclusion:** Although the well known suppressor effects of smoking on appetite and the lower prevalence of smoking in the first group, TM plus IDA have significant suppressor effects on weight, height, and BMI. In this field, TM and IDA must be researched separately to be able to understand the effects of low Hct values and/or iron deficiency with increased number of cases. Similarly, effects of higher BMI and smoking on BP must be researched separately with further studies, too.

**Key words:** Thalassemia minor, iron deficiency anemia, weight, height, body mass index, diastolic blood pressure, metabolic syndrome

## Introduction

Weight, height, and body mass index (BMI) are probably under the effects of various hereditary and environmental factors. Many studies assume that genes are important in them, and there is a common agreement that parents' weight and height affect the statures of the children (1, 2). External factors may also play roles on weight, height, and BMI. It was shown in the previous study that rural and urban living conditions may cause up to a 30% of difference in weight and a 12% difference in height (3). But there is still little known about genetic and environmental control of weight, height, and BMI. On the other hand, anemia is defined as a reduction of hemoglobin in red blood cells (RBC) and millions of people suffer from it. Iron deficiency anemia (IDA) and alpha and/or beta thalassemia minor (TM) are the most common causes of anemia in the world. Hemoglobin is the iron-rich protein of RBC that carries oxygen from lungs into the body. The final consequence is a decrease in the blood's ability to carry oxygen into the body, and supply it with the energy that it needs. So the important body processes including cell building, tissue repair, and muscular activity slow down in case of TM and IDA. Dizziness and a decrease in mental acuity may develop due to the lack of oxygen into the brain, and heart failure due to the increased work of the heart. Loss of appetite, palpitation, difficulty in concentration, depression, fatigue, coldness of extremities, pallor (reduced amount of oxyhemoglobin in the skin and mucous membranes), brittle nails, cessation of menstruation, breathlessness on exertion, glossitis (inflammation of the tongue), and angular cheilitis (inflammation of mouth corners) are the other common symptoms and signs seen with TM and/or IDA. All of the above symptoms and signs are related to the decreased cell turnover and increased work of heart due either to the decreased oxygen supply or to the decreased iron supplement of tissues. We tried to understand possible effects of TM plus IDA on weight, height, and BMI in the present study.

## Material and Methods

The study was performed in the Internal Medicine Units of the Dumlupinar and Mustafa Kemal Universities on routine check up patients between August 2007 and July 2016. The medical history of all cases including already used medications was learnt, and a routine check up procedure including fasting plasma glucose, creatinine, hepatic function tests, markers of hepatitis viruses A, B, C and human immunodeficiency virus, a posterior-anterior chest x-ray film, and an electrocardiogram were performed for all cases. Current daily smokers with six pack-months and cases with a past of three pack-years were accepted as smokers. Due to the very low prevalence of alcoholism in Turkey (4), we did not include regular alcohol intake into the study. Systolic and diastolic blood pressure (BP) were checked with a mercury sphygmomanometer after a five-minute rest in seated position in the office. Insulin using diabetics and patients with devastating illnesses including malignancies, chronic renal diseases, cirrhosis, hyper- or hypothyroidism, heart failure, thalassemia intermedia and major, sickle cell diseases (SCD), and autoimmune hemolytic anemias were excluded to avoid their possible effects on the weight, height, BMI, and hematocrit (Hct) values. Body weight and height was measured, and the BMI was calculated by the

same physicians instead of verbal expressions, since there is evidence that heavier individuals systematically underreport their weight relatively to the lighter ones (5). Weight in kilograms is divided by height in meters squared (6). IDA was diagnosed with serum iron, iron binding capacity, and ferritin. TM were diagnosed with hemoglobin electrophoresis performed via high performance liquid chromatography after the iron replacement therapy in cases with the IDA. Eventually, patients with TM plus IDA with a Hct level of lower than 30% were collected into the first, and age and sex-matched controls with a Hct level of 30% and greater were collected into the second groups, and compared in between. Mann-Whitney U test, Independent-Samples T test, and comparison of proportions were used as the methods of statistical analyses.

## Results

The study included 89 patients (65 females) with TM plus IDA in the first and 195 controls (143 females) in the second group, respectively. Their mean age and female ratio were 35.7 versus 35.3 years and 73.0% versus 73.3%, respectively ( $p>0.05$  for both). Mean Hct and mean corpuscular volume values were 23.2% versus 37.6% and 60.0 versus 81.1 fL, respectively ( $p=0.000$  for both). Weight (63.3 versus 70.9 kg,  $p=0.000$ ), height (161.2 versus 165.2 cm,  $p=0.001$ ), BMI (24.4 versus 25.9 kg/m<sup>2</sup>,  $p=0.007$ ), diastolic BP (78.9 versus 86.8 mmHg,  $p=0.000$ ), and smoking (8.9% versus 22.5%,  $p<0.01$ ) were all lower in the first group, significantly (Table 1 - next page).

## Discussion

IDA is the most common cause of anemia in the world, and mostly seen in children and women at the reproductive period due to the increased iron requirement in growth, menstruation, pregnancy, and lactation. For example, around 10% of adolescent girls and women in childbearing age have iron deficiency, compared with less than 1% of young men in the United States (7). These ratios are probably much higher in the underdeveloped and developing countries of the world. The female predominance (73.0%) and young mean age of the TM plus IDA patients (35.7 years) of the present study is probably due to menorrhagia since IDA can be caused by insufficient dietary intake of iron, insufficient absorption of iron, or blood loss which is often caused by menstruation. IDA induced symptoms and signs may be due to the tissue hypoxia and/or iron deficiency since iron takes vital roles in the various tissues and enzymes of the body. Glossitis, angular cheilitis, koilonychia (spoon-shaped nails), and dysphagia due to formation of esophageal webs in the Plummer-Vinson syndrome may be some of the indicators of various roles of iron other than the hemoglobin alone in the body. Thus moderate anemia induced retarded weight, height, and BMI in the present study may also be due to the various roles of iron in tissues and enzymes other than the hemoglobin alone. TM are the other most common causes of microcytic anemia in the world, particularly in the Mediterranean region. They are autosomal recessively inherited disorders. Normal hemoglobin is composed of two pairs of alpha and beta globin chains. Alpha thalassemias result in a decreased alpha globin synthesis, causing an excess of beta chains in adults. The excess beta chains form unstable tetramers (called hemoglobin H) which have abnormal oxygen

Table 1: Characteristic features of the study cases

Variables	Hematocrit values <30%	p-value	Hematocrit values ≥30%
Number	89		195
Age (year)	35.7 ± 13.8 (15-75)	Ns*	35.3 ± 11.4 (13-79)
Female ratio	73.0% (65)	Ns	73.3% (143)
<u>Hematocrit value (%)</u>	<u>23.2 ± 3.9 (14-29)</u>	<u>0.000</u>	<u>37.6 ± 4.2 (30-53)</u>
<u>MCV† value (fL)</u>	<u>60.0 ± 8.6 (45-97)</u>	<u>0.000</u>	<u>81.1 ± 7.1 (58-93)</u>
<u>Weight (kg)</u>	<u>63.3 ± 16.8 (37-119)</u>	<u>0.000</u>	<u>70.9 ± 15.4 (41-114)</u>
<u>Height (cm)</u>	<u>161.2 ± 8.3 (145-180)</u>	<u>0.001</u>	<u>165.2 ± 8.8 (147-189)</u>
<u>BMI‡ (kg/m<sup>2</sup>)</u>	<u>24.4 ± 6.9 (15.0-47.5)</u>	<u>0.007</u>	<u>25.9 ± 5.5 (17.8-42.0)</u>
<u>Smoking</u>	<u>8.9% (8)</u>	<u>&lt;0.01</u>	<u>22.5% (44)</u>
Systolic BP§ (mmHg)	127.3 ± 19.8 (80-190)	Ns	124.1 ± 21.3 (90-200)
<u>Diastolic BP (mmHg)</u>	<u>78.9 ± 11.6 (60-110)</u>	<u>0.000</u>	<u>86.8 ± 11.5 (60-130)</u>

\*Non-significant (p>0.05) †Mean corpuscular volume ‡Body mass index §Blood pressure

dissociation curves. Whereas in beta thalassemia, excess alpha chains bind to the RBC membranes causing membrane damage, and they form toxic aggregates at high concentrations. Generally, TM are prevalent in populations that evolved in humid climates where malaria is endemic since thalassemias protect these people from malaria due to the easy degradation of the RBC. Alpha and beta TM are also frequent in Turkey, particularly in the Mediterranean region. Pathophysiologic mechanisms of the significantly lower weight, height, and BMI of the TM plus IDA patients may include low Hct values induced tissue hypoxia, increased cardiac, bone marrow, and splenic activities, and some vital roles of iron in enzymes and tissues of the body. In this field, IDA and TM patients must be researched separately with increased number of cases in further studies. But it is obvious that neither the IDA nor the alpha and/or beta TM do not shorten lifespan of the human being, instead they may prolong the lifespan with some suppressor effects on weight and BMI in the metabolic syndrome.

Normally the weight, height, and BMI may be determined by a complex network of hormonal, nutritional, physical, and genetic factors. For example, around 70 genes may take a role in the regulation of bone mass (8), and some genes were shown to affect both the BMI and bone geometric parameters (9). The same results were also shown in animals where the results indicate substantial additive genetic control of Brahman body weight to hip height ratio (10). Leptin is a hormone produced

mainly by adipocytes, and it acts chiefly to control the body weight (11). Leptin is also expressed on osteoblasts, and acts as a skeletal growth factor and promotes bone mineralization (12, 13). The pleiotropic effect of leptin on the BMI and bone geometry may also be supported by the evidence of genetic correlation of leptin with the BMI and bone geometry (14). Whereas, the body length growth velocity was found not to be affected by genes in some studies (15). On the other hand, we detected in the present study that weight, height, and BMI were significantly retarded in the TM plus IDA patients (p< 0.05 for all). Whereas, in the previous study performed on 122 patients (58 females) with the SCD with a mean age of 28.6 years, although the BMI and weight were significantly retarded in the SCD cases (24.9 versus 20.7 kg/m<sup>2</sup> and 71.6 versus 57.8 kg, respectively, p= 0.000 for both) probably due to the accelerated vascular endothelial damaging process initiated at birth, the heights were similar in the SCD and control cases (166.1 versus 168.5 cm, respectively, p>0.05) probably due to its hereditary nature chiefly (16).

Chronic endothelial damage may be the major cause of aging by inducing disseminated tissue hypoxia all over the body. Some of the well-known accelerator factors of the inflammatory process are physical inactivity, sedentary lifestyle, excess weight, smoking, alcohol, chronic inflammation, prolonged infections, and cancers for the development of irreversible consequences including obesity, hypertension (HT), diabetes

mellitus (DM), cirrhosis, peripheral artery disease (PAD), chronic obstructive pulmonary disease (COPD), chronic renal disease (CRD), coronary heart disease (CHD), mesenteric ischemia, osteoporosis, and stroke, all of which terminate with early aging and premature death. They were researched under the titles of metabolic syndrome, aging syndrome, and accelerated endothelial damage syndrome in the literature, extensively (17-19). The syndrome may be the most common type of vasculitis all over the world. Much higher BP of the afferent vasculature may be the major underlying cause by inducing recurrent injuries on endothelium. Thus the term of venosclerosis is not as famous as atherosclerosis in the literature. Secondary to the chronic endothelial damage, inflammation, edema, and fibrosis, vascular walls become thickened, their lumens are narrowed, and they lose their elastic nature which reduces blood flow and increases systolic BP further. Although early withdrawal of causative factors may prevent final consequences, after development of obesity, HT, DM, cirrhosis, PAD, COPD, CRD, CHD, mesenteric ischemia, osteoporosis, or stroke, endothelial changes cannot be reversed completely due to their fibrotic nature (20, 21). Other chronic inflammatory processes including SCD, rheumatologic disorders, prolonged infections, and cancers may accelerate the process. Finally it is not a surprise that the metabolic syndrome terminates with a shortened survival in human beings (22).

Alcohol and smoking cause a chronic inflammatory process on the vascular endothelium depending on the concentrations of their products in the blood. So both of them can cause an accelerated atherosclerosis, end-organ insufficiency, early aging, and premature death. Thus both of them should be included among the major components of the metabolic syndrome. Atherosclerotic effects of smoking are the most obvious in Buerger's disease. It is an obliterative vasculitis characterized by inflammatory changes in the small and medium-sized arteries and veins, and it has never been reported in the absence of smoking in the literature. On the other hand, smoking in human beings and nicotine administration in animals may be associated with a decreased BMI value. Nicotine supplied by patch after smoking cessation decreased caloric intake in a dose-related manner (23). According to an animal study, nicotine lengthens intermeal time and decreases amount of meal eaten (24). Additionally, the mean BMI seems to be the highest in the former, the lowest in the current, and medium in the never smokers (25). Smoking may be associated with a postcessation weight gain (26). Similarly, although CHD was detected with similar prevalences in both genders, prevalence of smoking and COPD were higher in males against the higher BMI, low density lipoproteins, triglycerides, white coat hypertension, HT, and DM in females (27). Similarly, the prevalence of myocardial infarction is increased six-fold in women and three-fold in men who smoke 20 cigarettes per day (28). In another definition, smoking is more dangerous for women due to the associated excess weight and its consequences in them. So smoking is probably a powerful atherosclerotic risk factor with some suppressor effects on appetite (29). Smoking-induced weight loss may be related to the smoking-induced chronic vascular endothelial inflammation all over the body since loss of appetite is one of the major symptoms of disseminated inflammation all over the body. Physicians can even understand healing of their patients by means of their normalizing appetite. Several toxic

substances found in the cigarette smoke get into the circulation by means of the respiratory tract, and cause a vascular endothelial inflammation up to the clearance from the circulation. But due to the repeated smoking habit, the clearance process never terminates. So the patients become ill with loss of appetite, permanently. In another explanation, smoking-induced weight loss is an indicator of being ill instead of being healthy. After smoking cessation, appetite comes back with a prominent weight gain but the returned weight is their physiological weight, actually. Despite the well known suppressor effects of smoking on appetite and the lower prevalence of smoking in the first group, weight was significantly lower in the TM plus IDA group in the present study.

As a conclusion, although the well known suppressor effects of smoking on appetite and the lower prevalence of smoking in the TM plus IDA group, TM plus IDA have significant suppressor effects on weight, height, and BMI. In this field, TM and IDA must be researched separately to be able to understand the effects of low Hct values and/or iron deficiency with increased number of cases. Similarly, effects of higher BMI and smoking on the BP must be researched separately with further studies, too.

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# Systemic disorders in the pathophysiology of rheumatic heart disease

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## ABSTRACT

**Background:** We tried to understand roles of systemic disorders in the pathophysiology of rheumatic heart disease (RHD).

**Methods:** All patients who applied to the Internal Medicine Units were included.

**Results:** We detected 29 females and 20 males with RHD. Their mean ages were 42.7 versus 33.0 years, respectively ( $p= 0.016$ ). There were 26 cases with sickle cell diseases (SCDs), two cases with rheumatoid arthritis (RA), two cases with systemic lupus erythematosus (SLE), one case with juvenile rheumatoid arthritis (JRA), one case with common variable immunodeficiency, one case with celiac sprue, two cases with cirrhosis, and one case with chronic renal disease. In other words, there were associated systemic pathologies in 73.4% of RHD patients. Mitral valve was involved in 41.3%, mitral and aortic valves were involved in 26.0%, mitral and tricuspid valves were involved in 17.3%, aortic valve was involved in 8.6%, and all of the three valves were involved in 6.5% of the cases. In another definition, mitral, aortic, and tricuspid valves were involved in 91.3%, 41.3%, and 23.9% of cases, respectively. Interestingly, tricuspid valve was never involved alone, instead always together with mitral valve.

There were 69.3% of patients with mitral regurgitation, 26.5% with aortic regurgitation, 22.4% with tricuspid regurgitation, 20.4% with mitral stenosis, and 18.3% with aortic stenosis.

**Conclusion:** Systemic disorders including SCDs, RA, SLE, and JRA induce chronic inflammatory processes on vascular endothelium in the whole body, and terminate with an immunosuppression by several mechanisms that may be the cause of higher prevalence of RHD together with such disorders.

**Key words:** Rheumatic heart disease, sickle cell diseases, rheumatoid arthritis, systemic lupus erythematosus, chronic endothelial damage, atherosclerosis, immunosuppression

## Introduction

Chronic endothelial damage may be the major cause of aging by inducing disseminated tissue hypoxia all over the body. Much higher blood pressure (BP) of the afferent vasculature may be the major underlying cause, and probably whole afferent vasculature including capillaries are mainly involved in the process. Some of the well-known accelerators of the inflammatory process are physical inactivity, excess weight, smoking and alcohol for the development of irreversible consequences including obesity, hypertension, diabetes mellitus, cirrhosis, peripheral artery disease (PAD), chronic obstructive pulmonary disease (COPD), chronic renal disease (CRD), coronary heart disease (CHD), mesenteric ischemia, osteoporosis and stroke. They were researched under the title of metabolic syndrome in the literature, extensively (1-4). Similarly, sickle cell diseases (SCDs) are severe and chronic inflammatory processes on vascular endothelium, terminating with end-organ insufficiencies in early years of life. Hemoglobin S causes loss of elastic and biconcave disc shaped structures of red blood cells (RBCs). Probably loss of elasticity instead of shape is the main problem since sickling is rare in peripheral blood samples of the SCDs with associated thalassemia minor and human survival is not so affected in hereditary spherocytosis or elliptocytosis. Loss of elasticity is present during the whole lifespan, but exaggerated with various stresses of the body. The hard RBCs induced severe and chronic vascular endothelial damage, inflammation, edema, and fibrosis terminate with tissue hypoxia all over the body (5, 6). Capillary systems may mainly be involved in the process due to their distribution function for the hard bodies. In another definition, metabolic syndrome is an accelerated atherosclerotic process, and SCDs are an accelerated metabolic syndrome. We tried to understand roles of systemic disorders in the pathophysiology of rheumatic heart disease (RHD).

## Material and Methods

The study was performed in Internal Medicine Units of the Dumlupinar and Mustafa Kemal Universities between August 2005 and July 2016. All patients applied to the Internal Medicine Units were included into the study. The SCDs were diagnosed with hemoglobin electrophoresis performed via high performance liquid chromatography. A complete physical examination of all study cases was performed by the same internist. A check up procedure including fasting plasma glucose, creatinine, hepatic function tests, markers of hepatitis viruses A, B, C and human immunodeficiency virus, a posterior-anterior chest x-ray film, an electrocardiogram, a Doppler echocardiogram both to evaluate cardiac walls and valves and to measure systolic BP of pulmonary artery, and an abdominal ultrasonography were performed for all cases. CRD is diagnosed with a persistent serum creatinine level of 1.3 mg/dL in males and 1.2 mg/dL in females. Cirrhosis is diagnosed with physical examination, liver function tests, ultrasonographic evaluation, and tissue samples in case of requirement. RHD is diagnosed with the echocardiographic findings. Patients with rheumatoid arthritis (RA) are classified with the criteria of early rheumatoid arthritis (ERA) (7). The ERA criteria include a morning stiffness of 30 minutes or longer, arthritis of three or more joint areas, arthritis of hand joints, positivity of rheumatoid factor (RF), and positivity of anti-cyclic citrullinated peptide antibody (anti-CCP). RA is

defined by the presence of three or more of the criteria. Systemic lupus erythematosus (SLE) is classified with the criteria of American College of Rheumatology of 1997 including discoid rash, immunologic features, photosensitivity, neurologic disorders (headache, depression, seizures, and psychosis), oral ulcers, malar rash, arthritis, serositis, hematologic disorders (leukopenia, lymphopenia, thrombocytopenia, and hemolytic anemia), antinuclear antibodies (ANA), and renal involvement (proteinuria, low complement, red blood cell casts, granular casts) (8). Four of them are required for classification but not for diagnosis. Juvenile rheumatoid arthritis (JRA) is classified, clinically (9). Common variable immunodeficiency (CVID) is diagnosed with the clinical history, serum immunoglobulin (Ig) levels, and exclusion of other possible causes (10). Celiac sprue is diagnosed by the clinical history, IgA antiendomysial antibodies, and jejunal biopsy in case of requirement (11). Eventually, all cases with the RHD and their associated disorders were detected. Independent-Samples t test was used as the method of statistical analysis.

## Results

We detected 29 females and 20 males with the RHD. Their mean ages were  $42.7 \pm 17.8$  (19-77) versus  $33.0 \pm 9.1$  (22-55) years, respectively ( $p=0.016$ ). There were 26 cases with the SCDs, two cases with RA, two cases with SLE, one case with JRA, one case with CVID, one case with celiac sprue, two cases with cirrhosis, and one case with CRD. In other words, there were associated systemic pathologies in 73.4% of the RHD patients. Mitral valve alone was involved in 41.3%, mitral and aortic valves were involved in 26.0%, mitral and tricuspid valves were involved in 17.3%, aortic valve alone was involved in 8.6%, and all of the three valves were involved in 6.5% of the cases. In another definition, mitral, aortic, and tricuspid valves were involved in 91.3%, 41.3%, and 23.9% of cases, respectively. Interestingly, tricuspid valve was never involved alone, instead always together with mitral valve. There were 69.3% of patients with mitral regurgitation, 26.5% with aortic regurgitation, 22.4% with tricuspid regurgitation, 20.4% with mitral stenosis, and 18.3% with aortic stenosis.

## Discussion

Chronic endothelial damage may be the leading cause of aging in human beings. It may be the most common type of vasculitis all over the world at the moment. Whole afferent vasculature including capillaries may chiefly be involved in the process. Much higher BP of the afferent vasculature may be the major underlying cause by inducing recurrent injuries on endothelium. Therefore the term of venosclerosis is not as famous as atherosclerosis in the medical literature. Physical inactivity, excess weight, smoking, alcohol, chronic inflammations, prolonged infections, and cancers probably accelerate the process. Secondary to the chronic endothelial damage, inflammation, edema, and fibrosis, vascular walls become thickened, their lumens are narrowed, and they lose their elastic nature which reduces blood flow and increases systolic BP further. Although early withdrawal of underlying factors may delay terminal consequences, after development of cirrhosis, COPD, CRD, CHD, PAD, or stroke, endothelial changes cannot be reversed completely due to their fibrotic nature (12).

SCDs are life-threatening hereditary disorders affecting around 100,000 individuals in the United States (13). As a difference from other causes of chronic endothelial damage, the SCDs may keep vascular endothelium particularly at the capillary level (14), because the capillary system is the main distributor of the hard RBCs into the tissues. The hard cells induced severe and chronic endothelial damage, inflammation, edema, and fibrosis terminate with end-organ insufficiencies in early years of life. As a result, mean lifespans of the patients were 48 years in females and 42 years in males in the literature (15), whereas they were 33.3 and 30.8 years, respectively in our previous study (16). Unfortunately, the great differences may be secondary to delayed diagnosis, delayed initiation of hydroxyurea therapy, and inadequate RBCs supports during medical and surgical emergencies in Antakya region of Turkey. Actually, RBCs supports must be given in all medical and surgical emergencies in which there is evidence of clinical deterioration in the SCDs (17, 18). RBCs supports decrease sickle cell concentration in the circulation, and suppress bone marrow for the production of abnormal RBCs. So it decreases sickling induced endothelial damage all over the body. According to our 20-year experiences, simple RBCs transfusions are superior to the exchange. First of all, preparation of one or two units of RBCs suspensions in each time rather than preparation of six units or more provides time for clinicians to prepare more units by preventing sudden death of such patients. Secondly, transfusion of one or two units of RBCs suspensions in each time decreases the severity of pain, and relaxes anxiety of the patients and surroundings in a short period of time. Thirdly, transfusions of lesser units of RBCs suspensions in each time decrease transfusion-related complications in the future. Fourthly, transfusions of RBCs suspensions in the secondary health centers prevent some deaths developed during transport to the tertiary centers for the exchange. Fifthly, transfusions of RBCs suspensions in the secondary health centers prevent some extra costs on the health system developed during the exchange in the tertiary centers. On the other hand, longer survival of females in the SCDs (15) and longer overall survival of females in the world (19) cannot be explained by the atherosclerotic effects of smoking and alcohol alone, instead it may be explained by stronger physical efforts of male sex in life that may terminate with an exaggerated sickling and an exaggerated chronic endothelial damage in their bodies (20).

RHD is caused by an autoimmune reaction against Group A  $\beta$ -hemolytic streptococci. The majority of morbidity and mortality associated with rheumatic fever is caused by its destructive effects on cardiac valves. It is characterized by repeated inflammation with fibrinous repair. Fibrosis and scarring of valve leaflets, commissures, and cusps leads to abnormalities that can result in valvular stenosis or regurgitation. The valvular endothelium is a prominent site of lymphocyte-induced damage. Normally, T cell activation is triggered by presentation of the bacterial antigens. In RHD, molecular mimicry results in incorrect T cell activation, and these T lymphocytes can go on to activate B cells, which will start to produce self-antigen-specific antibodies. This leads to an immune response attack mounted against tissues in the heart that are misidentified as pathogens. RHD usually occurs after repeated attacks. Rheumatic fever primarily affects children between the ages of 5 and 17 years. In one third of cases, the underlying Strepto-

coccal infection develops without any symptom. On the other hand, some patients develop significant carditis that manifests as congestive heart failure. Unlike typical heart failure, rheumatic heart failure responds well to corticosteroids, probably due to its autoimmune nature. In Western countries, rheumatic fever has become fairly rare, probably due to the widespread use of antibiotics. RHD disproportionately affects women of reproductive age (21). Similarly, it was detected with a female ratio of 59.1%, and the mean age of females was 42.7 years in the present study. Rheumatic tricuspid valve dysfunction is the rarest of all valvular diseases, and is often associated with left-sided valvular diseases (22). The prevalence of rheumatic tricuspid dysfunction was 8.4% in a previous study (23). In another study, rheumatic tricuspid valve disease was detected with a ratio of 7.7%, and associated mitral valve disease was present in 99.3% of them (23). Whereas tricuspid valve was involved in 23.9% of cases, and never alone instead always together with mitral valve involvement in the present study. Mitral valve is involved in 97% of cases with the RHD (24), and mitral stenosis is classically caused by it (25). Similarly, mitral and aortic valves were involved in 91.3% and 41.3% of cases, respectively in the present study.

SCDs are severe inflammatory processes terminating with end-organ insufficiencies in early years of life (26). First of all, the SCDs are chronic hemolytic anemias in which the normal lifespan of RBCs decreased from the normal 120 to 15-25 days. Secondly, the severe and chronic endothelial inflammation all over the body causes an overlapping chronic disease anemia. Thirdly, the chronic hemolytic process may even cause folate and vitamin B12 deficiencies. Furthermore, end-organ insufficiencies can suppress the immune system of the patients. Frequent acute sinusitis, tonsillitis, and urinary tract infections are the common causes of painful crises and hospitalizations, and they can rapidly progress into the severe and life-threatening infections including pneumonia, meningitis, and sepsis due to the moderate to severe immunosuppression in such patients (27). For example, tonsillary hypertrophy is a common physical examination finding that may be the result of a prolonged infectious process due to the moderate to severe immunosuppression in them (28). Severe and prolonged endothelial inflammation induced prominent weight loss and cachexia are also frequent findings in the SCDs (6). As a result, menarche is retarded in females with the SCDs (29). Moderate to severe anemias, autosplenectomy, frequent painful crises, hospitalizations, invasive procedures, RBCs supports, medications, loss of appetite, cachexia, prevented normal daily activities, and a suppressed mood of the body may just be some of the possible reasons of immunosuppression in the SCDs (30-32). As a result, the significantly higher prevalence of RHD due to repeated bacterial infections should not be an amazing finding in patients with the SCDs.

RA is characterized by synovial inflammation and hypertrophy of the peripheral joints, potentially terminating with progressive destruction of articular and periarticular tissues (33). It typically affects small joints of hands and feet, but it can also affect larger joints (34). Fever, subcutaneous and visceral nodules, pleural and pericardial effusions, lymphadenopathy, splenomegaly, cytopenias, and episcleritis are just some samples of the extra-articular manifestations. Diagnosis is based

on the clinical history, acute phase reactants, and autoantibodies including RF and anti-CCP (35). The presence of clinical or subclinical synovitis detected with ultrasonography or magnetic resonance imaging is essential for early diagnosis. RA may also present with a large joint monoarthritis or oligoarthritis. In cases presenting with monoarthritis, careful assessment for differential diagnosis is needed, particularly in the older individuals where other conditions such as gout, calcium pyrophosphate deposition disease, and osteoarthritis are more common (36). Early referral of patients with suspected synovitis, particularly in small joints of hands and feet, is important in long-term outcomes (37). On the other hand, RA may mimic many systemic disorders, particularly in young and middle-aged females due to the extra-articular manifestations. According to our experiences, the diagnosis of RA requires trained clinicians who are able to differentiate early symptoms of RA from other pathologies, particularly from SLE. SLE is an autoimmune disease, too, and mostly seen in women with a younger mean age (38). Although the similar clinical presentation types, similar treatment agents, and similar prognosis, RA may have a lower prevalence in society (2.7% versus 6.0%,  $p < 0.001$ ), similar prevalences in both genders (50.0% versus 92.3% in females,  $p < 0.001$ ), and higher mean age of onset (44.5 versus 37.0 years,  $p = 0.038$ ) than the SLE (39). SLE can be distinguished by the characteristic skin lesions on light-exposed areas, oral aphthous lesions, nonerosive arthritis, positive antibodies to double-stranded deoxyribonucleic acid (DNA), renal and central nervous system (CNS) involvements, and cytopenias (38). Especially clinicians in the Hematology Clinics should be aware of SLE due to the associated thrombocytopenia in differential diagnosis with idiopathic thrombocytopenic purpura. The sera of most patients contain ANA, often including anti-double-stranded DNA antibodies (40). Articular symptoms are seen in 90% of patients, and they may exist for years before the diagnosis (41). For example, the average time from the onset of symptoms to diagnosis was 5 years in the above study (38). As a difference from RA, most lupus polyarthritis is nondestructive in nature. Cutaneous lesions include characteristic malar butterfly erythema, discoid lesions, and erythematous, firm, maculopapular lesions of face, sun-exposed areas of neck, upper chest, and elbows. Photosensitivity is seen in 40% of cases. Generalized lymphadenopathy is also common. CNS involvement may cause personality changes, stroke, epilepsy, and psychoses (42). Although the renal involvement may be fatal, the most common manifestation is proteinuria (43). There were increases in the incidences of renal involvement and neurological symptoms throughout the disease course (38). Early-stage SLE can be difficult to differentiate from RA if arthritic symptoms predominate (33-35). Thus, ANA and anti-double-stranded DNA antibodies should be studied in all patients suspected with RA (36, 37). Similarly, JRA is the most commonly seen chronic arthropathy before the age of 16 years (9). It is an autoimmune disorder, too. It can cause fever and anemia, and can also affect the heart, lungs, eyes, and the nervous system (9). The main difference between JRA and RA is that some children with JRA can get complete cure, while adults with RA usually have lifelong symptoms. Additionally, JRA may affect bone development as well as the child's growth. Beside that RF positivity is higher with RA than the JRA. The presence of RF positivity in the JRA indicates a higher risk of development of RA in adulthood. Immunosuppressive drugs, mainly the corti-

costeroids and methotrexate, are the major treatment approaches for all of the three disorders. On the other hand, chronic disease anemia, frequent hospitalizations, invasive procedures, RBCs supports, medications, loss of appetite, cachexia, prevented normal daily activities, and a suppressed mood of the body may just be some of the possible reasons of immunosuppression with such disorders. As a result, the higher prevalence of RHD due to repeated bacterial infections should not be an amazing finding in them, too.

As a conclusion, systemic disorders including SCDs, RA, SLE, and JRA induce chronic inflammatory processes on vascular endothelium all over the body, and terminate with an immunosuppression by several mechanisms that may be the cause of higher prevalence of RHD together with such disorders.

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# Quality of Child Birth in the North and South World: A Sociological Appraisal

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## ABSTRACT

Sociology as a dominant discipline usually assesses the two groups of countries in various terms. The industrial world (The North) is widely different from the countries of developing world (The South) including their demographic trends. The North world countries that experienced socio-cultural change earlier, their demographic norms and values have changed too in that, women have started giving birth to fewer children, followed by less maternal mortality and longer life expectancy for them. In African countries where women give birth to 7-8 children, they usually remain at very high risk. Sociology as a comprehensive social science investigates the cause-and-effect of high and low fertility rate within women. Quality of children in the South world countries among other factors remain poor from nutritional and educational viewpoints. One of the risks of high pregnancy and child birth is associated with deaths of mothers. Babies of such mothers are at the risk of low birth weight and often preterm birth. Average age of the first birth between 26 and 29 years, overall, provides better opportunities and quality of life to the newborns. While Africa is a great threat, as far as high birth rate is concerned, Asian (especially East Asian) countries are improving well, and currently have a Total Fertility Rate (TFR) of 1.5 children in their life time by an average woman. China also took a revolutionary step since 1979 to modify its population patterns. Method of research used in the present paper is of qualitative type, using documents to complete the manuscript.

**Key words:** Sociology. The North world. The South world. Child birth. Demographic norms.

## Introduction

Sociology as a comprehensive social discipline appraising and investigating various phenomena, and will now analyze the state of childbirth worldwide. For almost all women childbirth is a natural and happy experience through which new life is brought into the world. But, for increasing numbers of women who live in developing countries such as Niger, India, or Uganda, childbirth is a risky endeavour. Though humanity has so far continued through childbirth, and a result of which has been continuity of generations among nations, regardless of race, creed or religion, childbirth is facing complications because of science, technology, migration and organization around the world. Some countries that are more scientifically developed, face less problems, so far as child bearing is concerned. One of the risks of pregnancy and childbirth is associated with pregnancy-related deaths of women/mothers. Repeated and back-to-back pregnancies can deplete the mother's essential nutrients, giving the mother the risk of anemia and other complications including death. The babies of such mothers are at risk of low birth weight and preterm birth. In the countries where mothers give birth to 7-8 babies, mothers remain at very high risk. There is a clear connection between high fertility rate and maternal mortality rate. UNICEF indicates that women in countries like Niger, Afghanistan, Sierra Leon, Chad, Angola and many more, are at high risk of pregnancy-related diseases and other complications.

According to UNICEF lives of the newborns as well as the mothers could be saved simply through the right medications, improving health measures, educational development for the girls and the like. All such measures strongly prevent maternal deaths. In cases where women and girls are provided a low status in the society, their health needs are more often neglected.

## Method of Research

Methodology used in the present article is of qualitative type, in that, various paradigms have been used to find out facts regarding divorce. Qualitative research usually studies people or areas in their natural settings. In finding facts for the research, the researcher engaged in careful data collection and thoughtful analysis of what was relevant. In the documentary research applied in the present article, printed and written materials were widely regarded. The research was performed as a qualitative library type in which the researcher had to refer to relevant and related sources. In the current research various documents were thoroughly investigated, and the needful inferences were made. The data fed by the investigator in the present article is hopefully reliable. Though literature on childbirth is very limited, yet the author tried to investigate many different resources in order to elicit the necessary information to build up the text.

## Birth Rate

Childbearing comes into being through fertility achievement, and via male-female connection. According to United Nations, "Natural Fertility is the fertility which exists in the absence of deliberate birth control" (United Nations, 1973). According to the same source, controlled fertility is the fertility that involves a deliberate use of birth control (United Nations, 1973). On the other hand, the term birth control is used in a broad sense to include international abortions, sterilization and complete abstinence from coitus. Contraceptive method is sometimes taken as identical with birth control method, though it is a part of it. However, most persons use contraception and birth control in the same sense. Contraception, as is clear by the term is opposite of conception. Fertility refers to the actual reproductive performance \_\_\_\_ applied to an individual or a group (United Nations, 1973). Fertility can be measured through birthrate. So, a woman who has given birth to a live child is considered fertile. On the other hand, those who have not produced a single child are considered sterile. The total number of children born by one couple are known as "Family Size". The physiological limits of childbearing capacity over a period are known as "Theoretical Maximum Fertility". Similarly, abortions and stillbirth are classified as reproductive wastage. All those concepts are understood as the trends and causes of childbirth and fertility.

## Maternal Mortality vs Birth Rate

Maternal mortality is unacceptably high, more because of increasing childbirths among the women with the special reference to the developing countries. The majority of such deaths or about 90% occurring in low-infrastructure countries could have been prevented (WHO, 2019). Similarly, South Asian countries, and Sub-Saharan countries in Africa, approximately involved 254,000 or 86% of the world's maternal deaths in 2017. Risk of maternal mortality is highest for adolescent girls under the age of 15 years old and the complications in pregnancy and childbirth are higher among girls 10-19 as compared with age groups 20-24 (Ganchimeg, 2014).

Such catastrophes leave behind increasing issues for the remaining children in different stages of their lives. Such motherless children cannot easily access education, proper socialization, and alike. Eventually, they get into child-labor; a situation which will impact the next generation as well.

In high income countries one in every 5,400 die as a result of maternal death, while one in 45 happens in low income countries. Women die as a result of complications during and following pregnancy and childbirth. However, most of such complications are treatable, if infrastructure is available. In the case clinical management is maintained, a large number of maternal deaths among the women in developing countries could be prevented (Say, 2014). Poverty, distance to facilities, lack of information, inadequate and poor quality services, and finally cultural beliefs and practices are known as the main causes of maternal deaths (WHO, 2015).

**Table 1: Average age of first birth in selected developed nations by age, 2015**

US	26.4
Latvia	26.5
Poland	27.0
Slovakia	27.1
Estonia	27.2
Iceland	27.5
Hungary	27.9
Czech Republic	28.2
Canada	28.5
France	28.5
Belgium	28.7
Slovenia	28.7
UK	28.7
Finland	28.8
Norway	28.9
Austria	29.2
Denmark	29.2
Sweden	29.2
Germany	29.5
Portugal	29.5
Ireland	29.5
Netherlands	29.7
Greece	30.2
Luxembourg	30.2
Switzerland	30.6
Japan	30.7
Spain	30.7
Italy	30.8
South Korea	31.4

Note: All statistics are based on OECD countries available.

In countries like Poland, Iceland, and Norway and there are only three maternal deaths versus every 100,000 births, leaving behind golden opportunities for children so far as socialization and education are concerned.

### Health Policy vs Child Birth

During the past three decades many organizations have been engaged with progressive planning toward childbirth in increasing numbers of countries. In that, private providers have been active in low and middle-income countries in an effort to improve the reproductive behavior in the process of fertility (Ferrinho et al., 2001); (Zwi et al., 2001).

In some countries public and private health facilities both act simultaneously based on the choice of the clients, and are quality and cost (Hanson and Berman, 1998). But currently the available data do not show the increasing and in-depth participation of the private sector so far as maternal health across countries is concerned. In some cases, mothers who refer to a facility for delivery care, may choose the private facilities, though in many countries the public facilities are the main and first choice, yet for some reasons, some women may choose the private facilities. Literature on facility choice has found a wide range of determinants. Evidence through Asia has shown that socio-demographic groups most often of higher education contribute to private facilities choice by the women (Thind et al., 2008); (Berman and Rose, 1996). Other relevant factors like ethnicity and caste status are highly associated with the use of private facilities in India. Besides that, quality of income in the family plays a determining part in the choice.

**Table 2: Average number of lifetime births in selected developed nations by age, 2015**

Iceland	2.3
US	2.2
Norway	2.1
France	2.0
Sweden	2.0
Slovakia	1.9
UK	1.9
Finland	1.9
Hungary	1.9
Estonia	1.9
Czech Republic	1.8
Canada	1.8
Netherlands	1.8
Poland	1.8
Slovenia	1.7
Portugal	1.7
Switzerland	1.6
Austria	1.6
Germany	1.5
Italy	1.5
Spain	1.5
Japan	1.5

Note: All statistics are based on OECD countries available.

### Birth Rate in East Asia

Birth rates have widely fallen below 2.1 with special reference to South Korea where it has impacts on economic growth, cultural stability and other characteristics (Demeny, 2015). Declining fertility rate and contraction of labor force on the one hand, may have negative effects on economic growth and on the other hand, it has increased the wages of the current labor force in facilitating pensions, education, health care services etc. (Harper, 2014) ; ( Xing, 2016). South Korea has been experiencing a dramatic decline in birthrate since 1916 when six children were born per woman, and now it is known as one of the countries with the lowest birthrate in the world (Repetto, 2013). While the number of children and the youth declines, and the proportion of aging people increases, such a decline, in work force will ultimately impact the country's economic vitality, with regard to increased costs of health and social care services (Lunenfeld, 2013).

Industrialization is known to be a driving force for the decline in fertility in developing countries where technological and financial help for birth control is provided by international organizations. In addition, the decreasing birthrate is associated with norms, values and attitudes regarding marriage, lifestyle, parenthood, gender role, attitudes, gender quality values etc...(Ajzen, 2013); (Arpino, 2015). Similarly, higher rate of unemployment of young adults, nuclear family formation, gender equality issues and the like all helped change family

patterns in South Korea. The phenomenon has been continuing to recent time.

Population planning in South Korea has widely helped the country to grow up its industries, economy, international trade and overall its GDP per capital as compared with other Asian and developing countries. Currently, right after Japan, South Korea is counted as the most developed country in Asia.

### East Asian Marriage and Family

East Asia is known as a symbol of population policy and planning during the past half-century. Family behaviors and patterns widely changed in China, Japan, South Korea and Taiwan. These countries pay much attention to the family lineage and ancestor worship particularly pronounced in Chinese culture (Thompson, 1989). A great value in Chinese family is that children or grandchildren must respect the parent or grandparents (Thornton and Lin, 1994); (Whyte, 2004). It happens so with South Korean families and perhaps to a lesser degree with Japanese Families (Hashimoto and Ikeles, 2005).

China declared its one-Child Family in 1979; a plan that highly changed the family values and norms, brought more employment for the women, gave them more economic independence, gave them better health and so on. Single-child family continued in China until 2015, when the family was permitted to have a second child. Pressure of labor and employment caused the

**Table 3: % of women who never gave birth in selected developed nations, 201**

Czech Republic	9%
Hungary	11%
Denmark	12%
Portugal	12%
Slovakia	12%
Norway	13%
Slovenia	14%
US	14%
Sweden	14%
France	14%
Belgium	16%
Netherlands	18%
UK	18%
Ireland	19%
Austria	19%
Switzerland	19%
Finland	20%
Spain	21%
Italy	21%
Germany	23%

Note: All statistics are based on OECD countries available.

marriage age and childbearing to increase; the phenomenon that caused total fertility rate (TFR) to decline, and even many families remain childless in their lives. The whole scenario has contributed to the increase of the elderly people in those countries. Aging of population is also penetrating into the other developing countries too.

The social and demographic changes happening in the above four countries, will continue within the emerging generations in the years to come. Such milestones will remain and even switch to other generations contributing to further social changes in future. The demographic scenario will lead to a shortage of babies which must be compensated by electronic manpower.

### State of Childbirth in Africa

Childbirth in Africa is very poor and heartbreaking \_\_\_\_ most often it causes the death of the mother in the family. Pregnancy and childbirth complications are very common in developing countries, but much more widespread in African countries. Yet, women are known as a source of wealth and health in their communities, and without them family will not continue. In Africa, as researched , an amazing one woman in every 22 women dies in pregnancy- related complications, whereas in the UK one in every 8,000 deliveries leads to a maternal death. Traditions and norms contribute to repeated and continued births within the African women. Shortage of access to quality facilities, transportation, and trained midwives escalate the problem.

Many women in remote areas have to deliver their babies at home where they are likely to catch diseases or die. But, if there is a mother or grandmother beside her the chance of having a healthy baby and the unlikeliness of maternal death increases. On the other hand lack of transport and having to walk to the delivery center increases the chance of maternal death in African society.

Women undervalued and highly vulnerable, try to have more sons, a motion that increases their total fertility rate (TFR). However, newborn health and survival are much linked to the care the mother receives before and during pregnancy, childbirth and postnatal period. Throughout the continuum of care, the period of highest risk of disability and death, there are threats for both mothers as well the newborns. Labour, in the first few hours after delivery is there. Complications at this time are very likely for both mothers and babies with grave consequences (Retrieved, 2020). So, African countries need more investments and infrastructure to improve the situation so far as the maternal mortality and vulnerability are concerned.

### Causes of Low Fertility in Asia

Social modernization has caused increasing social change in many parts of Asia, among which low fertility is an effect. Social modernization such as increased schooling, extended average age of marriage, decreased marriage events and those occurring in later ages, provide the chance of fewer child bearings. Besides, as marriages happen late, many families cannot reach their son preference that they really wish for. So many of such countries will later face the imbalance of sex

**Table 4: State of maternal mortality in selected industrial countries, 2015**

Sweden	4
Norway	5
Switzerland	5
Austria	6
Germany	6
Canada	7
Netherlands	7
France	8
UK	9
New Zealand	11
US	14

Note: All statistics are based on OECD countries available.

ratio. Low fertility though not an issue at the time being, will be problematic later. So the higher causes of decreasing in the rise in Women education levels and employment rates.

Currently, the four most prosperous economies in Asia Japan, Singapore, South Korea and Taiwan, now have the lowest birthrates in the world despite the reported statistics, Survey results declare that all the young women in this societies wish to marry and have children. But, actually speaking, there is lack of childbearing in many parts of the world resulting in aging of population and shortage of young man-power.

However, despite maternity leave and child leave from work, assistance with childcare through daycare centers after school programs provision of housing facilities, medical insurance, expenses related to pregnancy and childbirth, women do not accept regular marriage and child bearing.

As sociologically observed, fertility in East Asian countries will remain low at least in the foreseeable future. Economic competition within the societies concerned (East-West Center, 2015), will retain population growth at a very low rate for the coming years.

## Conclusion

Sociology as a multi-dimensional discipline evaluates child-birth from different angles. This natural event is under social, economic and political decisions of governments. It is also under the quality of poverty and affluence of governments in different countries of the world, Countries with fast growing economies the initiative of lowering the birthrates is by any means. Similarly, as lifestyles of the youth are ever changing by education, employment, and other patterns, they marry late in their lives and have fewer children or none at all. Also, as the death rate has maximally declined, increasing numbers of young families do not have the motive to plan for large families. Change of standards like high quality of life, better education, better nutrition, and many more, have motivated young couples towards smaller families. In countries where male, female connections have been liberalized, family formation happens late, and the child is not anymore a value within many families. Birth control being highly used, it has lower TFT or total facil-

ity rate among many women. While the average TFR is 4.1 in the least developed countries, it is 1.6 in developed countries. This means that in developed countries 1.6 people replace two who die, and in this way population in these countries gradually shrinks, while in African countries the situation is reversed, and in that, population size annually boosts. The Phenomenon leads to poverty and lower quality of life. Increasing childbirth highly affects maternal and infant mortality rate. Many developing countries need to introduce effective policies to plan the population. In this way, they help themselves as well as the world as a whole.

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# Compliance with Infection Control Practices among Healthcare Practitioners in Saudi Arabia during Coronavirus Pandemic: Cross-Sectional Study

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## ABSTRACT

**Objective:** Coronavirus infection is currently responsible for considerable morbidity and mortality in Saudi Arabia and across the globe. The aim of this study was to determine the level of compliance to infection control practices among healthcare practitioners in the Kingdom of Saudi Arabia.

**Materials and Methods:** This cross-sectional study was conducted with 180 healthcare practitioners working in military, university, government and private hospitals in four (4) regions in Saudi Arabia, namely, Riyadh, Najran, Abha and Al Baha. Samples were selected using convenience sampling. The study utilized the following statistical formula: percentage distribution, mean, standard deviation and analysis of variance (ANOVA).

**Results:** Most of the healthcare practitioners were young adults, male, licensed physicians, Saudi citizens, doctoral degree holders, have 1 to 5 years of hospital experience, work in university hospitals, and lastly were assigned to a medical ward. Healthcare practitioners in Saudi Arabia have high compliance with infection control ( $\bar{x}=3.45$ ,  $SD\pm 0.28$ ) and very high compliance with contact precaution practices ( $\bar{x}=3.45$ ,  $SD\pm 0.82$ ) during the time of coronavirus pandemic. There is no significant difference in compliance with infection control ( $F=0.3404$ ,  $p=0.7963$ ) and contact precaution practices ( $F=0.3404$ ,  $p=0.7963$ ) among healthcare practitioners working in the different regions of Saudi Arabia.

**Conclusion:** Healthcare practitioners in Saudi Arabia usually comply to infection control practices and always comply with contact precaution. Also, health workers' infection control and contact precaution practices across Najran, Al Baha, Riyadh and Abha are the same and standardized.

**Key words:** compliance, infection control, hand hygiene.

## Introduction

The global battle to contain the novel coronavirus disease 2019 (COVID-19) pandemic rages on [1]. In the recent months, the World Health Organization (WHO) declared COVID-19 outbreak as a public health emergency of international concern. Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Understanding its burden as an emerging infectious disease is vital for devising appropriate infection control strategies [2].

Coronavirus infection is currently responsible for considerable morbidity and mortality in Saudi Arabia and across the globe [2]. Nearly four months have passed since the emergence but even up to this date there are no specific vaccines or treatments for COVID-19 [3]. This led to rapid spreading of the COVID-19 pandemic. In this light, Saudi Arabia was among the first countries to implement early and unprecedented precautionary strict measures to prevent virus entry to the country or to mitigate its impact when it arrives. The country has taken prompt strict public health measures to control and prevent the spread of the outbreak. In fact, Saudi Arabia has imposed a number of extreme measures on social movement, social and religious gatherings, travel, and businesses way before the first COVID-19 case was reported in the country [4].

Many infections acquired by patients can be spread by healthcare workers [5]. Health care workers can also act as reservoirs, harboring the microorganism for several days [6]. Thus, special attention should be addressed to health workers in hospital facilities as they play a significant role in disease transmission and healthcare-associated infections [1]. Transmission of healthcare-associated infections is still a major concern in point-of-care [7]. In fact, infection-related complications remain to be one of the most commonly reported medical errors committed by healthcare staff [8]. It was estimated that around 20% to 40% of healthcare-associated infections have been attributed to cross-infection from the hands of health care personnel as one of the major sources of nosocomial pathogens. Contamination of the hands of health care personnel could in turn result from either direct patient contact or indirectly from touching contaminated environmental surfaces [9]. The National Safety and Quality Health Service (NSQHS) Standards even reiterated that healthcare practitioners must adhere to strategies that prevent and control infection. This can be achieved by prudent use of antimicrobials, adhering to standard precautions and wearing of personal protective equipment [10].

Thus, the researcher came up with a paper entitled "Compliance to Infection Control Practices among Staff Nurses in Saudi Arabia" to determine the level of compliance to infection control practices among healthcare practitioners in Saudi Arabia.

### Statement of the Problem

In general, the researcher sought to determine compliance to infection control practices among healthcare practitioners in different tertiary hospitals in Saudi Arabia.

Specifically, it sought to answer the following questions:

1. What are the demographic characteristics of healthcare practitioners in terms of age, gender, profession, nationality, education, years of hospital experience, hospital setting, area of assignment, and facility location?
2. What is the level of compliance to infection control practices among healthcare practitioners during the coronavirus pandemic?
3. What is the level of compliance to contact precaution practices among healthcare practitioners during the coronavirus pandemic?
4. Is there a significant difference in compliance with infection control practices among healthcare practitioners in different regions in Saudi Arabia?
5. Is there a significant difference in compliance with contact precaution practices among healthcare practitioners in different regions in Saudi Arabia?

## Materials and Methods

This cross-sectional study was conducted in the following regions in Saudi Arabia, namely, Riyadh, Najran, Abha and Al Baha. The study was conducted simultaneously at one fixed point in time. Data collection was conducted at the time of coronavirus pandemic over a 4-month period from the months of March to May 2020. The study included a total of 180 healthcare practitioners (physicians, nurses, medical laboratory technician, and hospital administrators) as respondents of the study. Samples were selected using convenience sampling. Data gathering took place in selected military, university, government and private hospitals in different regions in the Kingdom of Saudi Arabia. Bioethical principles were strictly observed and implemented in the study. The respondents' rights and protection were taken into consideration throughout the conduct of the study. The observational data were entered into a Microsoft Excel database. Descriptive and inferential analysis were performed with Excel office with 95% confidence intervals. The study utilized the following statistical formula: percentage distribution, mean, standard deviation and analysis of variance (ANOVA).

A structured survey questionnaire was provided to the respondents of the study. Healthcare practitioners were asked to complete the survey tool within 15 to 20 minutes. The Compliance to Key Performance Indicator (KPI) for Infection Control Tool was adapted from the Australian Commission on Safety and Quality in Healthcare [10]. The researcher utilized a 4-point Likert scale using the following rating scales: "3" which denotes always, "2" means sometimes, and "1" for never. In addition, the researchers have utilized Contact Precaution Monitoring Tool which was adapted from the Infection Control Program of the World Health Organization [3]. The use of contact precaution tool was used to monitor healthcare practitioners' compliance with hand washing practices in any of the following opportunities: before patient contact, before aseptic procedure, after body fluid exposure, after patient contact, and lastly after touching patient's surroundings. The said checklist tool was rated "4" for always, "3" for sometimes, "2" for seldom and "1" for never. Both research instruments were tested for content validity and construct validity by three (3) experts in the healthcare field. The said tools underwent a pilot study

on 20 hospital staff working in Najran University Hospital. The tools were tested for reliability and internal consistency. All research tools obtained a 0.78 and 0.85 Cronbach alpha reliability score and were considered acceptable and have a good internal consistency, respectively [11].

## Results

Table 1 depicts the demographic characteristics of healthcare practitioners as respondents of the study. Based on the data analysis performed, with a total of 180 respondents, it was found that most of the healthcare practitioners were young adults (n=112 or 62.2%), male (n=132 or 73.3%), licensed physicians (n=117 or 65.0%), Saudis (n=120 or 66.7%), doctoral degree holders (n=126 or 70.0%), have 1 to 5 years of hospital experience (n=79 or 43.9%), working in university hospitals (n=61 or 33.9%), were assigned to a medical ward (n=66 or 36.7%), and lastly came from Abha region in Saudi Arabia (n=62 or 34.4%).

Table 2 shows that the majority of healthcare practitioners perceived they have “high compliance” to infection control practices in terms of: wearing personal protective equipment ( $x=2.38$ ,  $SD\pm 0.69$ ), use alcohol-based hand rubs and sanitizers ( $x=2.24$ ,  $SD\pm 0.97$ ) and adhere to strict application to infection control policy ( $x=2.23$ ,  $SD\pm 0.77$ ). Similarly, respondents displayed “very high compliance” in being aware of infection control policy in their respective hospitals ( $x=2.88$ ,  $SD\pm 0.40$ ), and perceive infection control policy is a crucial factor in controlling infections ( $x=2.81$ ,  $SD\pm 0.42$ ). On the contrary, healthcare practitioners in Saudi Arabia demonstrated “moderate compliance” in wearing personal protective equipment ( $x=2.10$ ,  $SD\pm 0.83$ ), “low compliance score” in using antimicrobial soap with running water ( $x=1.57$ ,  $SD\pm 0.80$ ), and “very low compliance” in attending seminars and workshop about infection control ( $x=1.38$ ,  $SD\pm 0.72$ ).

Table 3 shows compliance with contact precaution practices among healthcare practitioners during the time of the coronavirus pandemic. Accordingly, the findings of this study revealed that most of the healthcare practitioners in Saudi Arabia have “very high compliance” ( $x=3.45$ ,  $SD\pm 0.82$ ) with contact precaution practices during the coronavirus pandemic. Specifically, the majority of healthcare practitioners perceived they have “very high compliance” with contact precaution after touching the patient ( $x=3.44$ ,  $SD\pm 0.90$ ), after exposure to patients’ body fluid ( $x=3.85$ ,  $SD\pm 0.45$ ) and before performing aseptic procedures ( $x=3.67$ ,  $SD\pm 0.73$ ). On the other hand, healthcare practitioners only have “high compliance level” with contact precaution before patient contact ( $x=3.16$ ,  $SD\pm 0.95$ ), and after touching patients’ surroundings ( $x=3.13$ ,  $SD\pm 1.06$ ).

Table 4 depicts the test of significant difference in the level of compliance to infection control practices among healthcare practitioners in the different regions of Saudi Arabia. Analysis of Variance (ANOVA) One-way factor revealed no significant difference ( $F=0.3404$ ,  $p=0.7963$ ) in compliance with infection control practices among healthcare practitioners working in the different regions of Saudi Arabia. Thus, health workers’ infection control practices across Najran, Al Baha, Riyadh and Abha are the same and standardized.

Table 5 depicts the test of significant difference in the level of compliance with contact precaution practices among healthcare practitioners in the different regions of Saudi Arabia. Analysis of Variance (ANOVA) One-way factor revealed no significant difference ( $F=0.3404$ ,  $p=0.7963$ ) in compliance with contact precautions among healthcare practitioners working in the different regions of Saudi Arabia. Thus, health workers’ contact precaution practices across Najran, Al Baha, Riyadh and Abha are the same and standardized.

## Discussion

Most of the healthcare practitioners were young adults, male, licensed physicians, Saudi citizens, doctoral degree holders, have 1 to 5 years of hospital experience, work in university hospitals, were assigned to a medical ward, and lastly came from Abha region in Saudi Arabia. Most healthcare practitioners were young adults which is the expected age bracket for newly graduated healthcare practitioners who just secured a professional license and are beginning a professional career as healthcare practitioners. These age groups are more eager to work, can perform multitasking, and can work under pressure which can create a significant impact during their professional practice in their respective clinical work settings. Moreover, the results also suggest that registered healthcare practitioners are relatively younger and were assumed to be more receptive to the challenges of infection control practices [12]. Most healthcare practitioners were doctoral degree holders being their highest education attained. Tanner [13] notes that healthcare practitioners with higher degrees are especially well-suited in meeting complex healthcare demands, reducing patient risk, and lowering mortality. Thus, proceeding to higher education will enhance and guide the competence of hospital staff in formulating, implementing and evaluating evidence-based patient care that will improve infection control. Most healthcare practitioners have 1 to 5 years of hospital experience. A study by Altuntas & Baykal [14] emphasizes that newly licensed practitioners entering the health care facilities demonstrate little involvement, but are necessitated to assume full responsibility for patient care. Furthermore, this creates a labor difficulty and job annoyance which can drastically affect patient care and organizational commitment practices. Most healthcare practitioners were assigned to a medical ward. The high rates of self-reported compliance score among hospital staff are consistent with previous hospital areas of assignment that also indicated high rates of self-reported compliance with infection control practices [5]. Most healthcare practitioners worked in Abha province in Saudi Arabia. A study in United States showed that healthcare workers practicing in rural health care facilities had 40% decreased certification in infection control than those healthcare workers who practiced in urban health care facilities. Accordingly, there was a statistically significant decreased certification within suburban areas, but statistical findings revealed that healthcare facility location was not a significant predictor of certification for an infection control program [15].

The majority of healthcare practitioners in Saudi Arabia have “high compliance level” to infection control practices during the coronavirus pandemic. This implies that hospital staff often practice measures that prevent and control infection. Such findings of the study are supported by studies in Philippines,

**Table 1: Demographic Characteristics of Healthcare Practitioners as Respondents of the Study**

Demographic Characteristics	Frequency (n)	Percentage (%)
<b>A. Age</b>		
21-35 years old (Young adults)	112	62.2
36-55 years old (Middle adults)	48	26.7
56-65 years old (Late adults)	20	11.1
<b>B. Gender</b>		
Male	132	73.3
Female	48	26.7
<b>C. Profession</b>		
Medical Doctor	117	65.0
Nurses	46	25.6
Healthcare Administration	7	3.9
Medical Laboratory	10	5.5
<b>D. Nationality</b>		
Saudi	120	66.7
Non-Saudi (Sudanese, Filipino, Indian, Egyptian, Yemeni, British)	60	33.3
<b>E. Education</b>		
Diploma	8	4.4
Bachelor	31	17.2
Master	15	8.3
Doctoral	126	70.0
<b>F. Years of Hospital Experience</b>		
< 1 year (novice)	15	8.3
1 to 5 years (advanced beginner)	79	43.9
6 to 10 years (competent)	55	30.6
11 to 20 years (profident)	25	13.8
≥20 years (expert)	6	3.3
<b>G. Hospital Setting</b>		
University Hospital	61	33.9
Military Hospital	49	27.2
Ministry of Health Hospital	57	31.7
Private Hospital	13	7.2
<b>H. Area of assignment</b>		
General ward	62	34.4
Medical ward	66	36.7
Pediatric ward	35	19.4
Intensive care unit	17	9.4
<b>I. Facility Location</b>		
Riyadh	54	30.0
Najran	35	19.5
Abha	62	34.4
Al Baha	29	16.1
<b>TOTAL</b>	<b>N=180</b>	<b>100.0%</b>

**Table 2: Compliance with Infection Control Practices among Healthcare Practitioners in Saudi Arabia**

Infection Control Practices	Mean (n=180)	SD	Level of Compliance
<b>A. Statements</b>			
1. Wear personal protective equipment (PPE) like gloves, gown, mask	2.38	0.69	High Compliance
2. Timely use of alcohol-based hand rubs and sanitizers.	2.24	0.97	High Compliance
3. Use antimicrobial soap with running water	1.57	0.80	Low Compliance
4. Compliance with hand hygiene protocols.	2.10	0.83	Moderate Compliance
5. Awareness and understanding about the infection control policy in your hospital.	2.88	0.40	Very High Compliance
6. Perceive infection control policy as crucial factor in controlling infections.	2.81	0.42	Very High Compliance
7. Attended infection control programs like seminar, workshop, training.	1.38	0.72	Very Low Compliance
8. Strict application of infection control policy in the work setting.	2.23	0.77	High Compliance
<b>TOTAL</b>	<b>2.21</b>	<b>0.70</b>	<b>High Compliance</b>

Legend: 1.00-1.40 Very low compliance; 1.41-1.80 Low compliance; 1.81-2.20 Moderate compliance; 2.21-2.60 High compliance; and 2.61-3.00 Very high compliance

**Table 3: Compliance with Contact Precautions among Healthcare Practitioners in Saudi Arabia**

Infection Control Practices	Mean (n=180)	SD	Level of Compliance
<b>A. Statements</b>			
1. Before patient contact	3.16	0.95	High Compliance
2. After touching the patient	3.44	0.90	Very High Compliance
3. After body fluid exposure	3.85	0.45	Very High Compliance
4. After touching patients' surroundings	3.13	1.06	High Compliance
5. Before an aseptic procedure	3.67	0.73	Very High Compliance
<b>TOTAL</b>	<b>3.45</b>	<b>0.82</b>	<b>Very High Compliance</b>

Legend: 1.00-1.60 Very low compliance; 1.61-2.20 Low compliance; 2.21-2.80 Moderate compliance; 2.81-3.40 High compliance; and 3.41-4.00 Very high compliance

**Table 4: Test of Significant Difference in the Level of Compliance with Infection Control Practices among Healthcare Practitioners in Different Regions in Saudi Arabia**

Groups	Count	Sum	Average	Variance
Najran	8	17.16	2.145	0.293114286
Al Baha	8	16.76	2.095	0.297
Riyadh	8	18.79	2.34875	0.324498214
Abha	8	17.17	2.14625	0.276598214

Analysis of Variance (ANOVA): One-Way Factor

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.304075	3	0.101358333	0.340354002	0.796296868*	2.946685266
Within Groups	8.338475	28	0.297802679			
Total	8.64255	31				

\*p-value is significant if  $p < .05$

**Table 5: Test of Significant Difference in the Level of Compliance with Infection Control Practices among Healthcare Practitioners in Different Regions in Saudi Arabia**

Groups	Count	Sum	Average	Variance
Najran	5	17.39	3.478	0.11572
Al Baha	5	15.72	3.144	0.15983
Riyadh	5	18.7	3.74	0.03445
Abha	5	16.63	3.326	0.14858

Analysis of Variance (ANOVA): One-Way Factor

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.9538	3	0.317933333	2.773198424	0.07529116*	3.238871517
Within Groups	1.83432	16	0.114645			
Total	2.78812	19				

\*p-value is significant if  $p < .05$

Bangladesh, and United States. Accordingly, hospital staff have a high compliance score to key performance indicators for patient safety outcomes in terms of infection control [16]. A study in Bangladesh shows a significant improvement in the infection control practices among health practitioners [17]. Furthermore, anecdotal reports from management showed statistical significant improvements in healthcare worker's compliance with basic infection control practices [18]. Controlling healthcare-associated infections and strict compliance with infection control standards among healthcare practitioners is imperative. Preventing the patient from acquiring infections in the healthcare facilities can reduce potential harm, comorbidities and achieve favorable health outcomes for the patients. Although healthcare practitioners have high compliance with infection control, it was observed that hospital staff demonstrated low compliance scores in the following: a) using antimicrobial soap with running water for hand washing and b) attending seminars and workshop about infection control. It must be known that cleaning hands with antimicrobial soap and running water is an effective way to prevent the transmission of disease-causing microorganisms [19]. When health care workers do not follow appropriate infection control measures, their hands and clothing can easily become contaminated [6]. Hand hygiene is a fundamental infection control strategy for the prevention of pathogen transmission in healthcare facilities [20]. Thus, the success of hand hygiene programs depends on high compliance rate among hospital staff [21].

Most of the healthcare practitioners in Saudi Arabia have "very high level of compliance" to hand hygiene protocols during coronavirus pandemic. Similarly, a study by Garcell et al. [22] cited that high hand hygiene compliance score (91.6%) was observed among nurses in Qatar. The highest compliance score was observed after blood and body fluid exposure (80.0%) and after patient contact (85.5%). On the contrary, a study in China reported that adherence to hand hygiene recommendations among healthcare workers remains suboptimal with a compliance rate of 30% [23]. Hand hygiene is known as a fundamental and essential tool for reducing healthcare-acquired infections [24]. Careful adherence to hand hygiene before and after patient contact is needed by healthcare personnel to further protect themselves and patients [25]. Failure to adhere to proper hand hygiene practices is thought to be the leading cause of transmission of cross-infections [26]. Microbial infection and colonization can occur when pathogens are transferred from the hands of healthcare workers to the environment and to patients [20]. Regular hand hygiene is proven effective in killing microorganisms on hands. According to the National Health Service (NHS) in the United Kingdom, hand hygiene is the simple, most cost-effective and important strategy for the prevention of the spread of infection [22,27]. Lastly, the best way to prevent and slow down transmission is to be well-informed about the coronavirus (COVID-19) virus, the disease it causes and how it spreads. This can be achieved by protecting oneself and others from infection by performing hand washing or hand hygiene meticulously [3].

There is no statistically significant difference in compliance to infection control and hand hygiene practices among healthcare practitioners working in the different regions of Saudi Arabia. The study finding is contradicted by a study in Australia. Accordingly, compliance among healthcare workers have shown highly variable rates from below 50% to close to 90%. Although the National Hand Hygiene Initiative was overwhelmingly successful in the majority of the states in Australia as it was associated with decreased infection rates but it seems that it is counter-productive and had quite a different result in South Australia. The disruption in infection control practices in South Australia showed a significant increase in infection rates. The difference is attributed to shifting away from other infection control programs and resources resulting in unintended consequences [19]. These differences in hand hygiene practices and standard precautions could be due to the variations by country and healthcare settings [5]. Infection control and hand hygiene practices among healthcare practitioners should be standardized across the globe regardless of the regions, resources, and facilities. The 2014 Society for Healthcare Epidemiology of America (SHEA) even cited that hand hygiene is a key strategy which is essential in breaking the transmission cycle from healthcare workers, patients and the environment [20]. Meanwhile, a study has observed that there is a wide variation in the scope and lacks detail of infection control guidelines. The need to develop national guidelines that provide a legally binding framework for the healthcare facility and training for infection prevention needs to be implemented in healthcare institutions of their respective countries. Harmonizing infection control programs rely on common taxonomy, state-of-the-art guidelines, and health recommendations from various countries. Currently, there is no harmonized guidelines and protocols on the most important healthcare-associated infections topics and infection control strategies [28]. Thus, the success of the programs depends primarily on a high compliance rate to infection control and standardized infection prevention practices among hospital staff [21].

## Conclusions

Healthcare practitioners in Saudi Arabia usually comply with infection control practices and always comply with contact precaution at this time of pandemic. Also, health workers' infection control and hand hygiene practices across Najran, Al Baha, Riyadh and Abha are the same and standardized. An infection control training program is recommended in future research to improve strict compliance of healthcare professionals to infection control practices like hand hygiene, use of personal protective equipment, and contact precaution among others. Comprehensive infection control measures should be emphasized, demonstrated, and implemented by hospital staff in each clinical area of assignments. Thus, the need to develop competencies among healthcare practitioners in complying with infection control practices must be strictly emphasized especially during this time of coronavirus pandemic. It is clear that additional work is required to address the noncompliance rate to hand hygiene initiatives among some health care staff working in hospitals.

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