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CORRELATION BETWEEN PHYSICAL ACTIVITY AND GALLSTONES IN JEDDAH, SAUDI ARABIA

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Abstract:

Background:

Gallstones are collections of solid material that form inside the gallbladder, it is a common and important cause of hospitalization. Obese people were at an increased risk for developing gallstones, the prevalence of obesity in the Middle East is considered high. Several researches have reported an inverse relationship between symptomatic gallstone and increased physical activity, however there is no similar study conducted in Saudi Arabia.

Method:

This case-control study was conducted at King Abdul-Aziz University Hospital, Jeddah, Saudi Arabia, data of 120 participants were collected by telephone using Global Physical Activity Questionnaire [GPAQ] which is valid Questionnaire. Assessing vigrous, moderate and mild activities

Results:

A total of 120 patients were enrolled in the study. Males represented more than half of the sample [56.7%], and most of the patients were Saudi nationals from Jeddah [66.7%]. The mean [SD] age of the patients was 48.4 [14.5] years, and the mean [SD] weight was 74 [10.7] Kg. The total number of patients with a diagnosis of gallbladder stones was 40 and they comprised 33.3% of the sample. Patients in the control group were not diagnosed with gall bladder stones. Control group spent slightly more days doing vigorous exercise [mean 0.7, SD 1.9] than those with gallbladder stones [mean 0.2, SD 0.98, p = 0.057]; however, the mean number of hours per day doing vigorous exercise did not differ between the two groups [p = 0.947]. There was a slight association between people's reported vigorous exercising weekly hours and their odds of having had a gallbladder stones [OR =1.183, p = 0.123]. Most of the other weekly exercise and activities correlated negatively with people's odds of having had gallbladder stones.

Conclusion:

Our data support the hypothesis that physical activity decreases the incidence of newly symptomatic gallstone disease. However further studies are needed to review the correlation between physical activity and prevention cholelithiasis.

Keywords: *Gall stones, Physical activity, Vigorous, moderate, walk.*

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INTRODUCTION:

Gallstones are collections of solid material that form inside the gallbladder, they may be as small as tiny specks or as large as the gallbladder itself. Gallstone disease is a common and important cause of hospitalization [1].

Acute cholangitis and pancreatitis are the most serious complications of gallstones, with considerable morbidity and mortality. Several factors are associated with an increased risks to develop gallstone disease. Several studies have shown that obesity is a strong risk factor [2,3].

In 1999, the third National Health and Nutrition Examination Survey estimated that 6.3 million men and 14.2 million women aged 20 to 74 in the United States had gallbladder disease [4]. Unfortunately, there was no reliable data on the prevalence of gallstone disease in Saudi Arabia. The prevalence of obesity in the Middle East is considered high, compared to the prevalence in Canada [22%] and the United States [21%] [5].

A study conducted in Saudi Arabia showed that the prevalence rates of obesity and overweight among 195874 participants were 43.8% and 35.1% , respectively. The peak prevalence of obesity was observed in the age group 50–59 years. Obesity was higher among women than men [6].

Several researches have reported an inverse relationship between symptomatic gallstone and increased physical activity [8]. In fact, physical activity is known to reduce the risk of metabolic abnormalities, including insulin resistance [9-10], high triglycerides [11], low levels of HDL cholesterol [11], diabetes, and obesity [12].

Many studies have shown that obese people were at an increased risk for developing gallstones, with a two- to five-fold risk reported in these individuals. The role of physical activity in the development of gallbladder disease has only recently been investigated but there is a paucity of data on the direct relationship between decreased levels of physical activity and gallstones [13-15].

How physical activity may influence gallbladder disease is somewhat mysterious. The suggested etiology include the impact of physical activity on gallbladder motility, elevated triglyceride levels, hyperinsulinemia and low plasma HDL levels [16,17].

Although many recently published studies recommend further investigation and researches for the correlation between physical activity and gallstone [18].

The aim of this work is to fill the gap between relationship of physical activity and the risk for symptomatic gallstone disease.

METHODOLOGY:

This case-control study was conducted at King Abdul-Aziz University Hospital, Jeddah, Saudi Arabia. Patients with symptomatic gallstones diagnosed by ultrasonography were assigned to the case group while patients in control group had other diseases rather than gall stones. Permission to conduct this survey approved by IRB We collected the data using the Global Physical Activity Questionnaire [GPAQ], which is a validated telephone questionnaire. Informed consent was sought and obtained from the participants verbally, and the patients' information was obtained from the hospital files.

People's physical activity and work-related activity level was assessed. They asked to indicate with Yes/No to four major types of physical exercise [vigorous and moderate] and work-related activity level [moderate and vigorous]. Also, they were asked to indicate the days per week they experienced such activities and how much time [in hours per day] they'd been doing such exercises and working activities.

The following data were collected: weight, height, lipid profile, and physical activity of the patients. The questionnaire measured the different types of activity: vigorous, moderate and light.

We compared their demographic, health-related and activity level factors using the t- tests of independent groups and the chi-squared test of association.

Multivariate Binary Logistic Regression was used to assess the individual and combined associations between people demographic and physical activity and exercise factors with their odds of having had gall bladder stone diagnoses

Statistical Analysis:

Google drive online forms were used to enter the data, and the Statistical Package for the Social Sciences software [SPSS Inc, Chicago, IL, USA], version 20.0, was used to analyze the data by odds ratio, and adjust the other confounder factors such as Obesity Sex and Age by using logistic regression. Due to our relatively small sample size, N=120, we determined to interact some variables, we multiplied each physical activity days by the hours expended by these people doing various types of work and exercise resulting in only five main product factors that reflect the hours of each activity per week. We used these proxy variables

instead of the raw variables to help us achieve more parsimonious model and to help us reduce collinearity between these factors.

RESULTS:

A total of 120 patients were enrolled in the study. Males represented more than half of the sample [56.7%], and most of the patients were Saudi nationals from Jeddah [66.7%]. The mean [SD] age of the patients was 48.4 [14.5] years, and the mean [SD] weight was 74 [10.7] Kg. The total number of patients with a diagnosis of gallbladder stones was 40 and they comprised 33.3% of the sample. Patients in the control group were not diagnosed with gall bladder stones [Table 1].

Table-1: People's demographic and health-related characteristics, N=120

	Frequency	Percentage
Sex		
Female	52	43.3
Male	68	56.7
Nationality		
Non-Saudi	40	33.3
Saudi	80	66.7
Age (years), mean(SD) , (min, max)		48.4 (14.5). (Min.=18, Max.=81)
Weight(Kg.), mean(SD)		74 (10.7))
Chronic illness		
No	69	57.5
Yes	51	42.5
Past Medical History, n=76		
Diabetes (Type-I and Type-II)	34	28.3
Hypertension	27	22.5
Hyperlipidemia	13	10.8
Other disease	6	5
Appendicitis	4	5.3
Inguinal Hernia	4	5.3
Peptic Ulcer	9	11.8
GERD	10	13.2
Kindy stone	50	56.8
Group		
Control=No gall stones	80	66.7
Cases= Gall stones	40	33.3

The majority of the respondents [89.2%] did not perform vigorous activities at work. The mean number of days per week during which , these people had been working as equal to 0.52 day per week [proximately one day per week]. 34% had agreed that they had performed moderate level of work. The mean number of days per week for those who performed moderately work was 1.7[nearly two] days per week SD=2.62.

Approximately 33.3% of the respondents walked or rode or bicycle regularly. The mean number of days per week during which they performed these activities was 1.62 days. The respondents indicated that they worked in sitting positions for about 5.2 hours per day [SD 4.6 hours] [Table 2].

Table-2: People's working and excercisig activity levels.N=120.		
	Frequency	**Percentage**
Undergoes Vigorous work		
No	107	89.2
Yes	13	10.8
Week days doing vigorous work , mean(SD)		0.52 (1.7)
Hours per day doing vigorous work, mean(SD)		0.7 (2.7)
Undergoes Moderate work		
No	79	65.8
Yes	41	34.2
Week days doing moderate work , mean(SD)		1.7 (2.62)
Hours per day doing moderate work, mean(SD)		1.12 (2.24)
Frequent walking		
No	80	66.7
Yes	40	33.3
Week days walking /cycling , mean(SD)		1.62 (2.7)
Daily hours walking /cycling, mean(SD)		0.34 (0.84)
Does Vigorous exercise		
No	97	80.8
Yes	23	19.2
Week days doing vigorous exercise, mean(SD)		0.7 (1.7)
Daily hours vigorous exercise, mean(SD)		0.23 (0.6)
Does Moderate exercise		
No	86	71.7
Yes	34	28.3
Week days doing Moderate exercise, mean(SD)		0.92 (1.5)
Daily hours Moderate exercise, mean(SD)		0.6 (0.94)
Hours per day performing job while sitting, mean(SD)		5.2 (4.6)

The chi-squared test of independence suggested that male were significantly less likely to have gallbladder stones than females [$p < 0.001$, Table 3]. Conversely, the case and control groups did not differ in terms of age, nationality, weight, chronic illness, and medical history]. An independent groups t-test indicated that people in the control group spent slightly more days doing vigorous exercise [mean 0.7 , SD 1.9] than those with gallbladder stones [mean 0.2, SD 0.98, $p = 0.057$]; however, the mean number of hours per day doing vigorous exercise did not differ between the two groups [$p = 0.947$].

Moderate exercise exposure and the mean number of days per week did not differ between cases and controls; however, a significant difference in the number of hours per day was noticed between the gall bladder diagnoses groups according to the independent t-test, people in the control group spent more time doing moderate exercise [mean 1.4, SD 2.5] than those with gallbladder stones [mean = 0.61, SD 1.7, $p = 0.038$]. Cases and control did not differ in their walking and cycling habits; however, there was a slight difference between cases and controls in the mean number of days per week during which they walked, with those in the control group reporting more walking days [$p = 0.069$].

The mean hours per day walking, or cycling, differed significantly between these two groups. An independent t-test showed that people in the control group spent more hours per day walking and cycling [mean 0.44, SD 1] than those in the case group [mean 0.14, SD 0.35, $p = 0.016$]

Table-3: People's demographic and health-related characteristics, n=120.

	Gall Stones			
	No	Yes		
	n=80	n=43	test statistic	p-value
Sex				
Female	26 (32.5%)	27 (65%)	$\chi2(1)=11.5$	0.001
Male	54 (67.5%)	16 (35%)		
Nationality				
Non-Saudi	30 (37.5%)	13 (25%)	$\chi2(1)=.65$	0.42
Saudi	50 (62.5%)	30 (75%)		
Age (years), mean(SD) , (min, max)	47.60 (14.1)	49.80 (15.3)	t(121)=0.793	0.429
Weight(Kg.) , mean(SD)	74.24 (11.2)	73.66 (10.1)	t(78)=0.246	0.809
Chronic illness				
No	47 (0.8%)	22 (51.2%)	$\chi2(1)=.65$	0.419
Yes	33 (41.2%)	21 (48.8%)		
Past Medical History				
Diabetes	22 (27.5%)	12 (30%)	$\chi2(1)=0.082$	0.774
Hypertension	19 (23.8%)	8 (20%)	$\chi2(1)=0.22$	0.643
Hyperlipidemia	10 (12.5%)	3 (7.5%)	$\chi2(1)=0.27$	0.604
Other diagnoses	3 (3.8%)	3 (7.5%)	$\chi2(1)=0.197$	0.657
Appendicitis	4 (5%)	0	$\chi2(1)=.917$	0.338
Inguinal Hernia	4 (5%)	0	$\chi2(1)=.917$	0.338
Peptic Ulcer	9 (11.2%)	0	$\chi2(1)=3.70$	0.055
GERD	10 (2.4%)	0	$\chi2(1)=5.851$	0.038
Kindy stone	50 (62.5%)	0	$\chi2(1)=45.30$	<0.001
Undergoes Vigorous work				
No	69 (86.2%)	41 (95.3%)	$\chi2(1)=1.60$	0.209
Yes	11 (13.8%)	2 (4.7%)		
Week days doing vigorous work , mean(SD)	0.7 (1.9)	0.20 (0.98)	t(120.9)=1.92	0.057
Hours per day doing vigorous work, mean(SD)	0.70 (0.7)	0.70 (3.4)	t(121)=0.74	0.947
Undergoes Moderate work				
No	52 (65%)	30 (69.8%)	$\chi2(1)=.29$	0.593
Yes	28 (35%)	13 (30.2%)		
Week days doing moderate work , mean(SD)	1.83 (2.7)	1.44 (2.4)	t(121)=0.77	0.441
Hours per day doing moderate work, mean(SD)	1.40 (2.5)	0.61 (1.7)	t(114.1)=2.1	0.038
Frequently walking/cycling				
No	52 (65%)	31 (72.1%)	$\chi2(1)=.641$	0.423
Yes	28 (35%)	12 (27.9%)		
Week days walking /cycling , mean(SD)	1.93 (2.9)	1.1 (2.2)	t(107.1)=1.84	0.069
Daily hours walking /cycling, mean(SD)	0.44 (1)	0.14 (.35)	t(108.89)=2.44	0.016
Does Vigorous exercise				
No	66 (82.5%)	34 (79.1%)	$\chi2(1)=.22$	0.642
Yes	14 (17.5%)	9 (20.9%)		
Week days doing vigorous exercise, mean(SD)	0.71 (1.8)	0.63 (1.6)	t(121)=0.30	0.797
Daily hours vigorous exercise, mean(SD)	0.22 (0.60)	0.25 (0.70)	t(121)=0.12	0.832
Does Moderate exercise				
No	46 (57.5%)	43 (100%)	$\chi2(1)=25.30$	<0.001
Yes	34 (42.5%)	0		
Week days doing Moderate exercise, mean(SD)	0.85 (1.3)	1.1 (1.8)	t(121)=0.80	0.437
Daily hours Moderate exercise, mean(SD)	0.70 (1.1)	0.40 (0.70)	t(117.81)=1.92	0.057
Hours per day performing job while sitting, mean(SD)	6.5 (4.5)	2.60 (3.3)	t(121)=5.03	<0.001

Multivariate logistic regression analysis was statistically significant [p < 0.001], denoting that at least one or more, of the tested predictor [independent variables], namely age, sex, nationality, presence of a comorbidity, weekly exercising or working measurements, was significantly associated with the odds of having had gallbladder stones. Moreover, the model was accurate at predicting true gallbladder status [p =0.246]. The area under the receiver operating curve [AUC]indicated an overall high specificity and sensitivity of this model at predicting the odds of having had gallstones versus none [AUC = 0.87, p < 0.001, 95% CI AUC : 0.81 :94].

Multivariate Logistic Regression Analysis of people's demographic, health=related and acitivity level with their adjusted odds of having had an Gall-bladder stones. N=120.

	B	S.E.	Wald	Ad. Odds Ratio	95% C.I.for O.R		Sig.
					Lower	Upper	
Sex=Male	-1.764	.575	9.415	.171	.056	.529	.002
Age (years)	.005	.021	.064	1.005	.965	1.047	.801
Nationality= Saudi	.354	.559	0.399	1.424	.476	4.263	.527
Comorbidity= Yes	.249	.571	.191	1.283	.419	3.929	.662
Vigorous work hours/week	-0.009	0.014	0.365	.991	.964	1.020	.546
Moderate work hours/week	-.069	.034	4.211	.933	.874	.997	.040
Walking hours per week	-.111	.088	1.614	.895	.753	1.062	.204
Vigorous exercise hours/week	.168	.113	2.199	1.183	.947	1.477	.138
Moderate exercise hours/week	-.113	.154	.535	0.893	.661	1.208	.465
Hours per week spend working while sitting	-.421	.096	19.113	0.656	.543	0.793	.000
Constant	2.033	1.266	2.581	7.639			.108

Multiple linear regression analysis showed that male patients were significantly less likely to have had gallbladder stones than females when the other variables were considered. Males were 82.7% times less likely to have gallbladder stones than females [p = 0.002]. Moreover, the model showed that moderate activity hours per week correlated significantly and negatively with the odds of having had gallbladder stones [OR = 0.933, p = 0.040, Figures 1 A and B]. On the contrary, people's hours sitting while working converged significantly and negatively with their odds of having had gallstones, with those who sat for longer hours tending to have lower a odds of having had gallstones [p < 0.001]. Other variables, including age, nationality, presence or absence of comorbidities, weekly vigorous working and exercising hours, and weekly moderate exercising hours, did not converge significantly with their adjusted probability of having had gallstones. However, there was a slight association between people's reported vigorous exercising weekly hours and their odds of having had a gallbladder stones [OR =1.183, p = 0.123]. Most of the other weekly exercise and activities correlated negatively with people's odds of having had gallbladder stones.

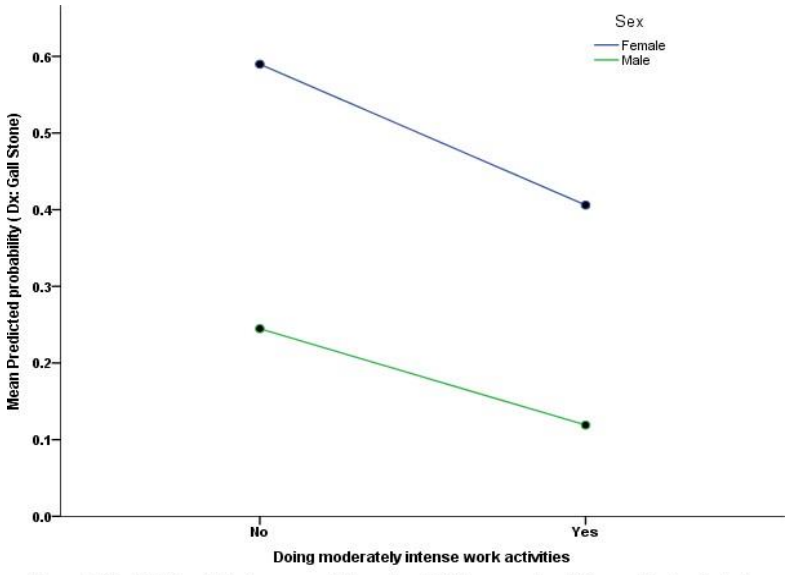

Figure-A: The Relationship between people's moderately intense work activities and their adjusted probability (i.e., propensity score) of having had an Gall Bladder Stones Diagnoses shown for both gender as a group.

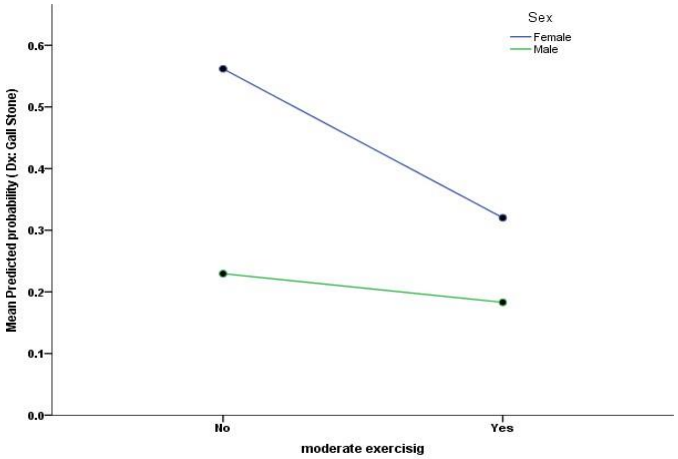

Figure-B: The Relationship between people's moderately intense excercising activity and their adjusted probability of having had an Gall Bladder Stones Diagnoses shown for both gender as a group.

DISCUSSION:

Gallstone disease is a major source of morbidity, they are twice as common in women as in men, but severe biliary events leading to surgery occur with equal frequency in the two sexes. it is currently the second leading cause of digestive-related hospital admissions, and direct health care expenditures [8].

This study was the first to examine the relationship between physical activity and gallbladder disease in KSA.

In our study is novel in our context in that it we explored the associations between demographic characteristics and physical activity with the odds of having had gallstones. It focuses not only on the correlation between physical activity and the likelihood of developing gallstones, but also on the effect of the duration and frequency of physical activity.

Results of our study reveal that male patients were 82.7% times less likely to have had gallbladder stones than females when other variables were considered.

Our findings support the view that occupational and physical activity levels were inversely related with developing gallbladder stones [19]. Previous studies reported that physical activity had a positive effect on gallstones [20–23], albeit there have been mixed reports, with some authors stating that further evidence was needed to make relevant conclusions [24].

Some investigators have proposed that physical activity may confer a protective effect against the development of gallstones by increasing gallbladder motility [25]. An increase in gallbladder motility is associated with a reduction in the concentration of biliary cholesterol, thereby preventing the precipitation of cholesterol in the bile [26,27]. Of note, there is evidence that physical activity affects the activity of hormones such as catecholamines, prostaglandins, endogenous opioid neuropeptides, and several hormones that enhance gallbladder motility [26]. Additionally, it is believed that physical activity indirectly affects gallbladder function by decreasing whole gut transit duration [25,26].

This study has potential limitations, including its retrospective design. Secondly, we relied on the self-report of the participants, which may have introduced confirmation bias in our analyses. Thirdly, our data do not permit us to establish a true cause and effect relationship for several reasons. Another major limitation of our study is the potential error in assessing physical activity levels, which relied principally on the self-report of the participants.

Nevertheless a significant difference in the number of hours per day was noticed between the gall bladder diagnoses groups and people in the control group who spent more time doing moderate work [mean 1.4, SD 2.5] than those with gallbladder stones [mean = 0.61, SD 1.7, p = 0.038]. There was no difference between both groups in their walking and cycling habits; however, there was a slight difference in the mean number of days per week during which they walked, with those in the control group reporting more walking days [p = 0.069].

CONCLUSION:

Our data support the hypothesis that physical activity decreases the incidence of newly symptomatic gallstone disease. The overall level of physical activity rather than any particular form of exercise is the main determinant. Physical activity may contribute to the prevention of symptomatic gallstone disease beyond its effect on weight control, it may be an important

determinant of symptomatic gallstone disease. The apparent protective effect is greatest for prolonged or vigorous physical activity but can also be achieved through moderate exercise, such as rapid walking or hiking.

These findings add to the evidence supporting a causal link between physical activity levels and a decreased risk of gallbladder disease, and they provide yet another reason to encourage the achievement and maintenance of a physically active lifestyle Further studies are needed to review the correlation between physical activity and prevention cholelithiasis.

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