Original Research Article

The effect of obesity, hypertension and diabetes on health-related quality of life among the elderly in the Eastern Province of Saudi Arabia

ABSTRACT

Aims: The purpose of this study was to study the cumulative effects of cardiovascular risk factors on all the health-related quality of life dimensions among the elderly.

Study design: The design of our study was cross-sectional
Place and Duration of Study: The population-based study covered participants, representative of the Saudi population aged 60 years and above in the Eastern province, during Nov 2021.
Methodology: Information was collected through home-based personal interviews by using a structured questionnaire on the participants' health. Informed verbal consent was taken and obtained from the participants. Multiple linear regression was used to examine the relationships between obesity, hypertension and diabetes and HRQL, on each scale of the SF-36 questionnaire, after adjusting for sociodemographic data and lifestyle factors.
Results: For males, Diabetes and hypertension registered the worst HRQL on all the scales (-53.8 to -22.0 points, according to the scale) in the two-factor cluster and all clusters except social functioning and role-emotional. Obesity and diabetes registered the worst HRQL on all the scales (–24.4 to –40.4 points, according to the scale) in two-factor female cluster except physical functioning, bodily pain, and general health and on all scales in all-female clusters except physical functioning, bodily pain, general health, social functioning and role-emotional.
Conclusion: our study showed that obesity, hypertension, and diabetes (as separate factors and in combination) affected negatively on HRQL.

Keywords: cardiovascular risk factors, elderly, quality of life, gender, Saudi Arabia.

1. INTRODUCTION

Obesity, hypertension, and diabetes incline to be correlated, obesity and diabetes are growing ~~an~~ at epidemic scale indicating that they are very common ~~in the~~ worldwide [1–3]. Diabetes in Saudi Arabia is commonly comorbid with obesity and hypertension, since diabetes prevalence was 19.9% among those who were obese compared to 10.7% among those who were not obese. Moreover, diabetes prevalence was 33.4% among those who were hypertensive compared to 9.6% among those who were not hypertensive [4]. Saudi Arabia is one of top ten countries of the world with highest prevalence of diabetes [9]. According to a report of survey by the Saudi Arabian Ministry of Health, approximately 0.9 million people were diagnosed with diabetes in 1992, but it grew to 2.5 million people in 2010, representing 2.7 times increase in the incidence rates in less than two decades and the Saudi Burden of Disease 2010

study showed that high plasma fasting glucose was 3rd ranked risk factor in disability-adjusted life years [4]. In 2015, 4660 patients with diabetes attended the family and medical clinics across Saudi Arabia [5]. Regrading to hypertension in Saudi Arabia, the Saudi Burden of Disease 2010 study showed that elevated blood pressure was the fourth-ranked risk factor for disability-adjusted life years (DALYs) in 2010 [6]. Moreover, the prevalence of hypertension in 2017 reaches 3.2% among those aged between 15-24 years, 51.2% among those aged 55-64 years and up to 70% among those aged 65 years and older. It has been observed that there is a growing in prehypertension cases, reaching 46.5% (3 million) among males and 34.3% (more than 2 million) among females [7]. In related to obesity, the Saudi Burden of Disease 2010 study showed that elevated body mass index (BMI) was the single leading risk factor for disability-adjusted life years (DALYs) in the Kingdom of Saudi Arabia in 2010 [8]. The prevalence of obesity, defined as a BMI of 30 kg/m2 or greater, was 28.7% in 2013. The prevalence was higher among females than males, 33.5% and 24.1% respectively. The prevalence increased by age and was highest among those aged 55 to 64, with levels of 48.0% [8]. Moreover, the burden of obesity, hypertension, and diabetes are globally considered huge in terms of morbidity, mortality, and healthcare costs [1, 2]. In KSA, Diabetes cost the nation an estimated $0.9 billion in 2010. People diagnosed with diabetes have medical healthcare expenditures that are ten times higher than what expenditures would be in the absence of diabetes [28]. Health-related quality of life is one of the important health outcomes, representing an extremely important goal of medical interventions. Also, assessment of the health-related quality of life is important for quality assurance and accountability for delivering good-quality care. Therefore, it is important medically to assess the effect of the cardiovascular factors more extensively by studying the HRQL for patients.

There are several studies about the effects of cardiovascular risk factors on the health-related quality of life which has been conducted and they have been generally concluded and demonstrated that they ~~adversely and negatively~~ have adverse and negative effect on HRQL globally [10 – 16], even though, the effect of obesity, hypertension, and diabetes on HRQL has been studied a little, particularly in elderly Saudi population [17-23]. It was found that some of them have been conducted on smaller sample size [19, 21, 22, 23], and others have not been conducted on all the HRQL scales [17, 19, 20]. Also, it found that some of them have not been conducted on lifestyle factors [17,18,19, 20, 21, 22]. Moreover, aging can deteriorate cardiovascular health [15].

This study examined the effect of obesity, hypertension, and diabetes (as separate cardiovascular factors and in combination) on all the physical and mental dimensions of HRQL [24, 25] among a representative sample of the Saudi elderly population in the Eastern province of Saudi Arabia. Specifically, this study hypothesized that the presence of obesity, hypertension, and diabetes as separated cardiovascular factors and in combination are associated with worse HRQL. In addition, the study investigated if the effect of these three cardiovascular factors on all the physical and mental dimensions of HRQL could be affected and explained by lifestyles such as physical activity, and smoking, by chronic diseases, and sociodemographic data and if they differ with the gender.

2. METHODOLOGY

The design of our study was a cross-sectional survey covering a sample representative of the Saudi population aged above 60 years in Eastern province of Saudi Arabia. This study was approved by research and ethics committee in

Deanship of Scientific Research of King Faisal University (Al-Ahsa city, Saudi Arabia).

Probabilistic, multistage, and cluster sampling were used to select the participants of the study. First, region of residence and size of town were the stratification of clusters. After that, per cluster, the district was selected randomly. Then, individual households and participants were selected in sex-based and age-based groups to obtain information to assess the HRQL.

Information was collected through home-based personal interviews by using a structured questionnaire on the participants' health. Informed consent was taken and obtained from the participants. The 396 participants provided complete information on all the study variables and subsequently were analyzed. The sample size was calculated for this study (n=[(z)2 (p) (p-1)]/(E)2 where n: sample size, z: reliability coefficient [z=1.96 for 95% confidence interval], p: expected population proportion with elderly patient having the mentioned cardiovascular risk factors = 50% =0.5, E margin error, by default equals 0.05). The minimum sample size according to the equation was 385. The investigators expected a response rate of 97%, therefore the estimated sample size was 396 patients.

Obesity is when a BMI of 30 or more is now widely accepted as denoting obesity [2]. Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more or a diastolic blood pressure (DBP) of 90 mm Hg or more, taking antihypertensive medication, or having been told by clinicians on at least 2 occasions as having hypertension [27]. Participants were considered to have diabetes, hypertensions, or obesity by reporting from the individual or physicians.

The study assessed the HRQL in elderly patients with diabetes, HTN, or obesity as a combination and separated cardiovascular factors. The Medical Outcomes Study (MOS) short form (SF-36) is a 36-item tool for assessing health status and outcomes from the patients' perceptions [24]. The English version of the RAND-36 is a reliable assessment of HRQL, and Cronbach's alpha values were ranged from 0.78 to 0.93 [24]. This questionnaire has already been translated into Arabic and it has been tested for internal consistency and reliability in a sample of Saudi Arabian populations [25]. It was found that both the Arabic and English versions of the RAND-36 are equivalent [24, 25, 26]. A previous study has been used the Arabic version of the RAND-36 to assess health-related quality of life, but this study was conducted in an adolescent population, not in the elderly [34]. In our study, elderly patients with diabetes, HTN, or obesity assessed their HRQL in terms of their satisfaction and feelings with regard to eight different components, with a total of 36 items addressing eight health concepts: physical function (10 items); physical role health (4 items); emotional role functions (3 items); vitality (4 items); emotional wellbeing (5 items); social function (2 items); bodily pain (2 items); and general health perceptions (5 items). Data from SF-36 were scored based on the scoring system reported by RAND Health. Each component has a single summary variable ranging from 0 = poor health to 100 = good health. The internal consistency and reliability of the SF36 has been investigated in a pilot study of 80 elderly patients with diabetes, HTN, or obesity. High internal consistency (Cronbach's alpha > 0.6) have been reported for physical function (Cronbach's alpha = 0.83); physical role health (Cronbach's alpha = 0.85); emotional role functions (Cronbach's alpha = 0.86); vitality (Cronbach's alpha = 0.81); emotional wellbeing (Cronbach's alpha = 0.71); social function (Cronbach's alpha = 0.69); bodily pain (Cronbach's alpha = 0.85); and general health (Cronbach's alpha = 0.63). In addition, the presence of any chronic diseases (chronic obstructive pulmonary disease, ischemic cardiopathy,

cerebrovascular disease, arthrosis, cancer, dyslipidemia, and stroke) was reported by the individual or their physicians during the interview.

All data, which was collected through home-based personal interviews by using a structured questionnaire on the participants' health, was stored in the database of version 25 of IBM SPSS statistics program to process and analyze.

2.1 statistical analysis

Multiple linear regression models were used to analyze statistically the effect of obesity, hypertension, and diabetes or any combination of the three on health-related quality of life. These seven different independent variables were modeled: solely obesity, solely hypertension, solely diabetes, only obesity, and hypertension, only obesity and diabetes, only hypertension and diabetes; all three risk factors. The reference group for them was the absence of the three risk factors (no factors) (participants with BMI lower than 30, and participants who did not report for diagnosing with diabetes or hypertension. $P < 0.05$ criterion was used for statistical significance, but the results are stratified for three levels of $P < 0.05$, < 0.01, and < 0.001. Descriptive statistics such as means, and standard deviation (mean ± SD) were used to describe the quantitative variables. Frequencies and percentages n (%) were used to describe all categorical variables and dummies were used to model all independent categorical variables. Data about sociodemographic variables was collected included (age, educational level, living alone, and size of town of residence) and for lifestyle habits (smoking), physical activity during leisure times, and chronic diseases. The sociodemographic variables and lifestyle factors were adjusted and categorized to several categories which included educational level for four categories (no formal education, primary, secondary, and university), size of town of residence for three categories (> 50000-100000; > 100000-500000; and > 500000 inhabitants), smoking for three categories (never smokers, ex-smokers, and current smokers), and physical activity for four categories (inactive, light, moderate, and intense). Lastly, living alone and chronic disease were categorized dichotomously.

3. RESULTS

The mean age of the participants was 67.14 (SD ±4.90) years for men and 69.9 (SD ±4.78) years for women. Of 396 participants included in the study, 52.8% were male and 47.2% were female as shown in Table 2. The sociodemographic characteristics of participants with obesity, hypertension, and diabetes are shown in Table 1. Regarding to males, the participants with obesity, hypertension, and diabetes represent the highest percentage (16.7%) of the male sample, and with obesity and hypertension represent the lowest percentage (7.2%) of the male sample. In addition, the participants with solely diabetes represent the highest mean age 70.94 (SD ±3.89) years and with hypertension and diabetes represent the lowest mean age 63.79 (SD ±3.99) years among male participants. Moreover, the participants with hypertension and diabetes represent the highest level of education (24.7%), with solely diabetes represent the highest percentage of the inactive physically during leisure time (25.6%), with no factor represent the highest percentage of the intense physically during leisure time (55.6%) among male. Also, the participants with no factor represent the highest percentage of non-smoker (23.7%) and no having other chronic diseases (44.6%) among, with hypertension and diabetes represent the highest percentage of smoker (23.3%), with obesity, hypertension, and diabetes represent the highest percentage of having other chronic disease (19.6%), with solely hypertension represent the highest percentage of living alone (40%), with solely hypertension represent the highest percentage of residence in town

whose size between 100000 and 500000 population (18.2%) among male participants. Regarding to females, the participants with obesity and diabetes represent the highest percentage 17.1% of the female sample and with obesity and hypertension and solely hypertension represent the lowest percentage 8% of the female sample. In addition, the participants with solely diabetes represent the highest mean age 75.15 (SD±3.33) and with solely obesity represent the lowest mean age 64.73 (SD±2.53), with solely obesity represent the highest level of education (44.8%), with obesity, hypertension, and diabetes represent the highest percentage of the inactive physically during leisure time (21.4%), with no factor represent the highest percentage of the intense physically during leisure time (55.6%), with obesity and diabetes represent the highest percentage of non-smoker (17.7%), with both solely hypertension and obesity and hypertension represent the highest percentage of smoker (40%), with obesity, hypertension, and diabetes represent the highest percentage of having other chronic disease (18.9%), with obesity and hypertension represent the highest percentage of living alone (85.7%), with obesity and hypertension represent the highest percentage of residence in town whose size between 100000 and 500000 population (18.5%) among female participants. Regarding to the mean of crude scores for the SF-36 scales, general health was the scale with the lowest mean of crude score 55.55 (SD±26.57) and social function was the scale with the highest mean of crude score 71.89 (SD±22.42) for males regardless of the risk factor considered. On other hand, physical function was the scale with the lowest mean of crude score 53.18 (SD±25.87), and social function was the scale with the highest mean of crude score 69.79 (SD±21.17) for females regardless of the risk factor considered shown in Table 2.

Table 1 sample characteristics of the study

		Diseases							
		No factor	Solely obesity	Solely hypertension	Solely diabetes	Obesity and hypertension	Obesity and diabetes	Hypertension and diabetes	Obesity, hypertension and diabetes
Male (N & %)		31 14.8%	16 7.7%	30 14.4%	32 15.3%	15 7.2%	21 10.0%	29 13.9%	35 16.7%
Age (years) (mean ± SD)		64.52 ±3.09	65.88 ±5.50	65.83 ±4.41	70.94 ±3.89	66.40 ±3.50	70.43 ±3.30	63.79 ±3.99	68.83 ±5.37
Educational level (N & %)	No formal education	0 0.0%	3 10.0%	2 6.7%	3 10.0%	2 6.7%	11 36.7%	0 0.0%	9 30.0%
	Primary	4 6.8%	2 3.4%	10 16.9%	23 39.0%	2 3.4%	4 6.8%	6 10.2%	8 13.6%
	Middle	0 0.0%	0 0.0%	3 75.0%	0 0.0%	1 25.0%	0 0.0%	0 0.0%	0 0.0%
	Secondary	10 37.0%	0 0.0%	3 11.1%	2 7.4%	2 7.4%	4 14.8%	1 3.7%	5 18.5%
	University	17 19.1%	11 12.4%	12 13.5%	4 4.5%	8 9.0%	2 2.2%	22 24.7%	13 14.6%
Smokers (N & %)	Non-smokers	28 23.7%	13 11.0%	12 10.2%	19 16.1%	7 5.9%	17 14.4%	6 5.1%	16 13.6%
	Ex-smokers	0 0.0%	0 0.0%	1 20.0%	0 0.0%	1 20.0%	0 0.0%	3 60.0%	0 0.0%
	Smokers	3 3.5%	3 3.5%	17 19.8%	13 15.1%	7 8.1%	4 4.7%	20 23.3%	19 22.1%

Physical activity during leisure time (N & %)	Inactive	2 2.4%	7 8.5%	9 11.0%	21 25.6%	11 13.4%	7 8.5%	9 11.0%	16 19.5%
	Light	3 4.2%	7 9.7%	10 13.9%	9 12.5%	3 4.2%	11 15.3%	15 20.8%	14 19.4%
	Moderate	14 35.0%	2 5.0%	9 22.5%	2 5.0%	1 2.5%	3 7.5%	4 10.0%	5 12.5%
	Intense	12 80.0%	0 0.0%	2 13.3%	0 0.0%	0 0.0%	0 0.0%	1 6.7%	0 0.0%
Other chronic diseases (N & %)	No	25 44.6%	4 7.1%	9 16.1%	4 7.1%	1 1.8%	2 3.6%	6 10.7%	5 8.9%
	Yes	6 3.9%	12 7.8%	21 13.7%	28 18.3%	14 9.2%	19 12.4%	23 15.0%	30 19.6%
Living Alone (N & %)	No	28 14.4%	16 8.2%	24 12.4%	28 14.4%	14 7.2%	20 10.3%	29 14.9%	35 18.0%
	Yes	3 20.0%	0 0.0%	6 40.0%	4 26.7%	1 6.7%	1 6.7%	0 0.0%	0 0.0%
Size of town of residence (N & %)	> 50000–100000	1 6.7%	0 0.0%	1 6.7%	1 6.7%	0 0.0%	1 6.7%	6 40.0%	5 33.3%
	> 100000–500000	25 15.7%	13 8.2%	29 18.2%	22 13.8%	15 9.4%	17 10.7%	23 14.5%	15 9.4%
	> 500000	5 14.3%	3 8.6%	0 0.0%	9 25.7%	0 0.0%	3 8.6%	0 0.0%	15 42.9%
Female (N & %)		21 11.2%	22 11.8%	15 8.0%	26 13.9%	15 8.0%	32 17.1%	27 14.4%	29 15.5%
Age (years) (mean ± SD)		67.62 ±4.34	64.73 ±2.53	69.53 ±2.56	75.15 ±3.33	67.20 ±4.28	73.34 ±3.00	69.85 ±4.79	68.59 ±3.20
Educational level (N & %)	No formal education	6 8.8%	1 1.5%	4 5.9%	24 35.3%	6 8.8%	16 23.5%	10 14.7%	1 1.5%
	Primary	7 12.1%	1 1.7%	8 13.8%	2 3.4%	8 13.8%	13 22.4%	6 10.3%	13 22.4%
	Middle	3 11.1%	6 22.2%	1 3.7%	0 0.0%	1 3.7%	2 7.4%	1 3.7%	13 48.1%
	Secondary	2 40.0%	1 20.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 20.0%	1 20.0%
	University	3 10.3%	13 44.8%	2 6.9%	0 0.0%	0 0.0%	1 3.4%	9 31.0%	1 3.4%
Smokers (N & %)	Non-smokers	21 12.0%	22 12.6%	10 5.7%	25 14.3%	14 8.0%	31 17.7%	23 13.1%	29 16.6%
	Ex-smokers	0 0.0%	0 0.0%	1 50.0%	1 50.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
	Smokers	0 0.0%	0 0.0%	4 40.0%	0 0.0%	1 10.0%	1 10.0%	4 40.0%	0 0.0%
Physical activity during leisure time (N & %)	Inactive	1 1.4%	14 20.0%	6 8.6%	11 15.7%	7 10.0%	10 14.3%	6 8.6%	15 21.4%
	Light	2 2.7%	8 10.7%	6 8.0%	8 10.7%	7 9.3%	17 22.7%	14 18.7%	13 17.3%
	Moderate	13 39.4%	0 0.0%	2 6.1%	6 18.2%	1 3.0%	4 12.1%	6 18.2%	1 3.0%
	Intense	5 55.6%	0 0.0%	1 11.1%	1 11.1%	0 0.0%	1 11.1%	1 11.1%	0 0.0%
Other chronic diseases (N	No	9 23.1%	4 10.3%	4 10.3%	6 15.4%	3 7.7%	7 17.9%	5 12.8%	1 2.6%

& %)	Yes	12 8.1%	18 12.2%	11 7.4%	20 13.5%	12 8.1%	25 16.9%	22 14.9%	28 18.9%
Living Alone (N & %)	No	21 11.7%	22 12.2%	15 8.3%	25 13.9%	9 5.0%	32 17.8%	27 15.0%	29 16.1%
	Yes	0 0.0%	0 0.0%	0 0.0%	1 14.3%	6 85.7%	0 0.0%	0 0.0%	0 0.0%
Size of town of residence (N & %)	> 50000–100000	1 7.7%	0 0.0%	3 23.1%	1 7.7%	0 0.0%	2 15.4%	3 23.1%	3 23.1%
	> 100000–500000	20 12.7%	22 14.0%	11 7.0%	19 12.1%	15 9.6%	29 18.5%	19 12.1%	22 14.0%
	> 500000	0 0.0%	0 0.0%	1 5.9%	6 35.3%	0 0.0%	1 5.9%	5 29.4%	4 23.5%

Table 2 sample characteristics of the study

Male (N & %)	209	52.8%
Age (years) (mean & SD)	67.14	4.90
Physical function (mean & SD)	55.89	26.06
Physical role health (mean & SD)	58.85	26.23
Bodily pain (mean & SD)	57.18	25.60
Vitality (mean & SD)	65.72	24.04
General health (mean & SD)	55.55	26.57
Social function (mean & SD)	71.89	22.42
Emotional role functions (mean & SD)	64.23	23.98
Mental health (mean & SD)	65.00	25.58
Female (N & %)	187.00	47.2%
Age (years) (mean & SD)	69.90	4.78
Physical function (mean & SD)	53.18	25.78
Physical role health (mean & SD)	56.60	24.49
Bodily pain (mean & SD)	57.81	23.69
Vitality (mean & SD)	64.06	22.14
General health (mean & SD)	55.37	24.34
Social function (mean & SD)	69.79	21.17
Emotional role functions (mean & SD)	63.21	26.20
Mental health (mean & SD)	67.09	23.11

Beta estimators of the effect of cardiovascular factors on the HRQL scales before adjustment of the sociodemographic variables and lifestyle factors for males and females are shown in Tables 3 and 4, respectively. Patients

with solely obese, solely hypertensive, or solely diabetic registered a worse HRQL (negative values of the b regression coefficient) on all the scales more frequently than those without the three risk factors although statistical significance (P < 0.05) was not present for some relationships in both genders except social functioning (0.286 of b regression coefficient) in female. ~~Regrading to~~ For male, diabetes was significantly associated with the greatest reduction in HRQL on all scales (– 29.3 to –41.2 points, according to the scale) in the single-factor cluster. In addition, the two-factor and three-factor clusters registered a worse HRQL (negative values of the b regression coefficient) on all the scales more frequently than those without ~~the~~ the three risk factors although statistical significance (P < 0.05) was not present for some relationships in both genders. For males, Diabetes and hypertension registered the worst HRQL on all the scales (– 20.9 to –47.5 points, according to the scale) in the two-factor cluster and all clusters except physical functioning, social functioning, and role-emotional. Obesity and diabetes registered the worst HRQL (-36.6 of the b regression coefficient) on physical functioning, solely diabetes registered the worst HRQL (-35.9 of the b regression coefficient) on social functioning, and obesity, hypertension, and diabetes registered the worst HRQL (-36.7 of the b regression coefficient) on role-emotional in all clusters. ~~Regrading to~~ For females, obesity was significantly associated with the greatest reduction in HRQL on all scales (– 17.4 to –30.05 points, according to the scale) in the single-factor cluster except bodily pain. Solely hypertension registered the worst HRQL (-27.3 of the b regression coefficient) on bodily pain in the single-factor cluster. Obesity and diabetes registered the worst HRQL on all the scales (–30.3 to –43.8 points, according to the scale) in the two-factor female cluster except physical functioning and general health and on all scales in all-female clusters except physical functioning, general health, and role-emotional. Obesity and diabetes registered the worst HRQL (-41.3 and -48.4 of the b regression coefficient) on physical functioning and general health in all-female clusters, respectively. Obesity, hypertension, and diabetes registered the worst HRQL (-49.6 of the b regression coefficient) on role-emotional in all-female clusters.

Table 3: Beta estimators of the effect of cardiovascular factors on HRQL scale (male)

	Single-factor cluster			Two-factor cluster			Three-factor cluster
	Solely obesity β (95% CI)	Solely hypertension β (95% CI)	Solely diabetes β (95% CI)	Obesity and hypertension β (95% CI)	Obesity and diabetes β (95% CI)	Hypertension and diabetes β (95% CI)	Obesity, hypertension, and diabetes β (95% CI)
Physical functioning	-21.190 (-34.973; -7.406)**	-7.231 (-18.699; 4.237)	-29.315 (-40.599; -18.030)***	-14.065 (-28.148; 0.019)	-36.636 (-49.291; -23.981)***	-34.616 (-46.184; -23.048)***	-33.065 (-44.108; -22.021)***
Role-physical	-22.419 (-36.121; -	-8.919 (-20.319;	-37.107 (-48.324; -	-18.086 (-32.085; -	-34.086 (-46.665; -	-40.006 (-51.504; -	-27.562 (-38.540; -16.585)***

	8.718)**	2.480)	25.890)***	4.087)*	21.507)***	28.507)***	
Bodily pain	-31.935 (-45.271; -18.600)	-13.102 (-24.197; -2.007)*	-32.092 (-43.009; -21.174)***	-14.602 (-28.228; -0.976)*	-30.269 (-42.513; -18.025)***	-42.453 (-53.645; -31.261)***	-33.078 (-43.763; -22.393)***
General health	-31.794 (-44.899; -18.689)***	-9.919 (-20.823; -0.984)	-40.076 (-50.804; -29.347)***	-19.086 (-32.476; -5.696)**	-37.181 (-49.213; -25.149)***	-47.592 (-58.590; -36.594)***	-30.848 (-41.348; -20.348)***
Vitality	-14.587 (-27.568; -1.605)*	-12.274 (-23.075; -1.474)*	-35.993 (-46.621; -25.365)*	-30.441 (-43.705; -17.177)***	-21.774 (-33.693; -9.855)***	-30.912 (-41.807; -20.017)***	-23.917 (-34.318; -13.516)***
Social functioning	-6.079 (-18.039; 5.882)	-12.349 (-22.301; -2.398)*	-34.047 (-43.839; -24.256)***	-20.516 (-32.737; -8.295)**	-28.564 (-39.545; -17.582)***	-25.895 (-35.933; -15.858)***	-13.373 (-22.956; -3.790)**
Role-emotional	-24.083 (-36.841; -11.324)***	-11.978 (-22.594; -1.363)*	-30.176 (-40.622; -19.731)***	-13.645 (-26.681; -0.609)*	-31.598 (-43.312; -19.883)***	-20.990 (-31.698; -10.282)***	-36.788 (-47.011; -26.565)***
Mental health	-7.611 (-19.885; 4.663)	-10.548 (-20.760; -0.336)*	-41.205 (-51.253; -31.156)***	-13.548 (-26.090; -1.007)*	-31.406 (-42.675; -20.136)***	-45.617 (-55.919; -35.316)***	-27.977 (-37.811; -18.143)***

Multiple linear regression models before adjustment of the sociodemographic variables and lifestyle factors. b, beta estimator; CI, confidence interval. *P < 0.05, ** P < 0.01, *** P < 0.001

Table 4: Beta estimators of the effect of cardiovascular factors on HRQL scale (female)

	Single-factor cluster	Two-factor cluster	Three-factor cluster

	Solely obesity β (95% CI)	Solely hypertension β (95% CI)	Solely diabetes β (95% CI)	Obesity and hypertension β (95% CI)	Obesity and diabetes β (95% CI)	Hypertension and diabetes β (95% CI)	Obesity, hypertension, and diabetes β (95% CI)
Physical functioning	-24.589 (-37.771; -11.406)***	-12.952 (-27.560; 1.655)	-7.683 (-20.361; 4.994)	-9.619 (-24.226; 4.988)	-32.359 (-44.493; -20.224)***	-41.323 (-53.895; -28.751)***	-35.435 (-47.816; -23.054)***
Role-physical	-25.877 (-83.589; -13.164)***	-15.286 (-29.372; -1.199)*	-12.555 (-254.780; -0.329)*	-15.286 (-29.372; -1.199)*	-43.817 (-55.519; -32.115)***	-31.508 (-43.632; -19.384)***	-21.872 (-33.812; -9.932)***
Bodily pain	-24.351 (-37.137; -11.564)***	-27.381 (-41.550; -13.564)***	-7.637 (-19.934; 4.660)	-27.048 (-41.217; -12.878)***	-32.589 (-44.360; -20.819)***	-29.974 (-42.168; -17.779)***	-30.369 (-42.379; -18.360)***
General health	-27.933 (-40.079; -15.787)***	-22.190 (-35.650; -8.731)**	-19.716 (-31.397; -8.035)**	-22.857 (-36.317; -9.398)**	-35.305 (-46.486; -24.124)***	- 48.413 (-59.997; -36.829)***	-41.765 (-53.173; -30.357)
Vitality	-22.738 (-34.334; -11.142)***	-0.238 (-13.088; 12.611)	-16.2 (-27.351; -5.048)**	-23.571 (-36.421; -10.722)***	-33.207 (-43.881; -22.532)***	-28.757 (-39.816: -17.697)***	-29.031 (-39.922; -18.14)***

Social functioning	-29.881 (-40.932; 18.830)***	0.286 (-11.960; 12.532)	-10.842 (-21.470; -0.215)*	-12.714 (-24.960; -0.468)*	-30.350 (-40.523; -20.177)***	-17.196 (-27.735; -6.656)**	-25.140 (-35.519; -14.760)***
Role-emotional	-17.435 (-30.573; --4.297)*	-18.238 (-32.796; -3.68)*	-10.11 (-22.745; 2.525)	-31.571 (-46.13; -17.013)***	-34.04 (-46.134; -21.946)***	-30.423 (-42.953; -17.893)***	-49.606 (-61.945; -37.267)***
Mental health	-30.054 (-42.735; -17.373)***	-8.19 (-22.242; 5.861)	-11.96 (-24.155; 0.236)	-15.19 (-29.242; -1.139)*	-31.659 (-43.332; -19.986)***	-25.82 (-37.914; -13.726)***	-18.604 (-30.514; -6.694)**

Multiple linear regression models before adjustment of the sociodemographic variables and lifestyle factors. b, beta estimator; CI, confidence interval. *P < 0.05, ** P < 0.01, *** P < 0.001

Beta estimators of the effect of cardiovascular factors on the HRQL scales after adjustment of the sociodemographic variables and lifestyle factors for males and females are shown in Tables 5 and 6, respectively. Patients with solely obese, solely hypertensive, or solely diabetic registered a worse HRQL (negative values of the b regression coefficient) on all the scales more frequently than those without the three risk factors except social functioning (3.2 of b regression coefficient) in females although statistical significance (P < 0.05) was not present for some relationships in both genders. ~~Regrading to~~ For male, diabetes was significantly associated with the greatest reduction in HRQL on all scales (–19.6 to –40.6 points, according to the scale) in single-factor except bodily pain and role-emotional. Obesity registered the worst HRQL on bodily pain and role-emotional (-38.7, and -23.14 points, according to the scale, respectively) in the male single-factor cluster. In addition, the two-factor and three-factor clusters registered a worse HRQL (negative values of the b regression coefficient) on all the scales more frequently than those without the three risk factors although statistical significance (P < 0.05) was not present for some relationships in both genders except solely diabetes in males, which has a greater decline in most of HRQoL scale than the combination of obesity and hypertension, the combination of obesity and diabetes, and the combination of three factors. For males, Diabetes and hypertension registered the worst HRQL on all the scales (-53.8 to -22.0 points, according to the scale) in the two-factor cluster and all clusters except social functioning and role-emotional. Obesity and diabetes registered the worst HRQL (-28.1 of the b regression coefficient) on social functioning in all-male clusters and the worst HRQL (-24.0 of the b regression coefficient) on role-emotional in the two-factor cluster. Obesity, hypertension, and diabetes registered the worst HRQL (-28.0 of the b regression coefficient) on role-emotional in all-male clusters. ~~Regrading to~~ For female, obesity was significantly associated with the greatest reduction in HRQL on all scales (– 9.3 to –28.7 points, according to the scale) in single-factor cluster except bodily pain,

vitality, and role-emotional although physical functioning, vitality, and role-emotional were not statistically significant ($P < 0.05$). Solely hypertension registered the worst HRQL (-31.2 of the b regression coefficient) on bodily pain and (-19.9 of the b regression coefficient) on role-emotional and solely diabetes registered the worst HRQL (-20.0 of the b regression coefficient) on vitality in the single-factor cluster. Obesity and diabetes registered the worst HRQL on all the scales (–24.4 to –40.4 points, according to the scale) in two-factor female cluster except physical functioning, bodily pain, and general health and on all scales in all-female clusters except physical functioning, bodily pain, general health, social functioning and role-emotional. Obesity and hypertension registered the worst HRQL (-32.7, -35.0, and -37.3 of the b regression coefficient) on physical functioning, bodily pain, and role-emotional in the two-factor cluster, respectively. Hypertension and diabetes registered the worst HRQL (-43.5 of the b regression coefficient) on general health in the two-factor cluster and all female clusters. Solely obesity registered the worst HRQL (-24.6 of the b regression coefficient) on social functioning in all female clusters. Obesity, hypertension, and diabetes registered the worst HRQL (-36.0, -38.8, and -48.3 of the b regression coefficient) on physical functioning, bodily pain, and role-emotional in all-female clusters, respectively. Therefore, the results of our study varied substantially and were affected in beta estimators of the effect of cardiovascular factors on the HRQL scales after adjustment of the sociodemographic variables and lifestyle factors.

Table 5: Beta estimators of the effect of cardiovascular factors on HRQL scale (male)

	Single-factor cluster			Two-factor cluster			Three-factor cluster
	Solely obesity β (95% CI)	Solely hypertension β (95% CI)	Solely diabetes β (95% CI)	Obesity and hypertension β (95% CI)	Obesity and diabetes β (95% CI)	Hypertension and diabetes β (95% CI)	Obesity, hypertension, and diabetes β (95% CI)
Physical functioning	-16.3 (-31.7; -0.9)*	-10.9 (-24.2; 2.4)	-19.6 (-34.4; -4.8)*	-15.2 (-31.5; 1.16)	-26.4 (-41,9; -11.0)**	-41.0 (-55.3; -26.7)***	-24.9 (-39.1; -10.6)**
Role-physical	-19.2 (-35.2; -3.3)*	-10.8 (-24.6; 3.0)	-32.2 (-47.6; -17.0)***	-16.9 (-33.8; -0.02)	-27.7 (-43.6; -11.7)**	-39.0 (-53.0; -24.2)***	-23.6 (-38.4; -8.9)**
Bodily pain	-38.7 (-54.6; -22.8)***	-22.8 (-36.5; -9.1)**	-36.8 (-52.0; -21.6)***	-22.4 (-39.2; -5.6)**	-39.4 (-55.3; -23.5)***	-53.8 (-68.6; -39.1)***	-40.3 (-55.0; -25.7)***
General	-31.1 (-46.8;	-14.5 (-28.2;	-34.4 (-	-20.6 (-37.3;	-34.2 (-	-52.0 (-66.7. -	-26.6 (-41.2; -

health	-15.3)***	-0.9)*	49.5; -19.3)***	-4.0)*	49.9; -18.4)***	37.4)***	12.1)***
Vitality	-19.9 (-35.5; -4.3)*	-20.5 (-34.0; -7.0)**	-38.6 (-53.6; -23.6)***	-35.5 (-52.0; -18.9)***	-27.9 (-43.5; -12.3)**	-39.0 (-53.5; -24.5)***	-26.7 (-41.1; -12.3)***
Social functioning	-6.2 (-20.1; 7.6)	-12.5 (-24.5; -0.5)*	-33.8 (-47.1; -20.5)***	-17.2 (-31.9; -2.6)*	-28.1 (-41.9; -14.2)***	-26.3 (-39.2; -13.5)***	-10.3 (-23.1; 2.5)
Role-emotional	-23.14 (-37.9; -8.4)**	-14.0 (-26.8; -1.3)*	-23.07 (--37.2; -8.9)**	-9.0 (-24.6; 6.7)	-24.0 (-38.7; -9.2)**	-22.0 (-35.7; -8.3)**	-28.0 (-41.6; -14.4)***
Mental health	-4.1 (-18.7; 10.5)	-11.6 (-24.2; 1.1)	-40.6 (-54.6; -26.5)***	-13.3 (-28.8; 2.2)	-34.4 (-49.1; -19.8)***	-40.6 (-54.2; -26.9)***	-26.5 (-40.0; -13.0)***

Multiple linear regression models after adjustment of the sociodemographic variables and lifestyle factors. b, beta estimator; CI, confidence interval. *P < 0.05, ** P < 0.01, *** P < 0.001

Table 6: Beta estimators of the effect of cardiovascular factors on HRQL scale (female)

	Single-factor cluster			Two-factor cluster			Three-factor cluster
	Solely obesity β (95% CI)	Solely hypertension β (95% CI)	Solely diabetes β (95% CI)	Obesity and hypertension β (95% CI)	Obesity and diabetes β (95% CI)	Hypertension and diabetes β (95% CI)	Obesity, hypertension, and diabetes β (95% CI)
Physical functioning	-14.9 (-31.5; 1.8)	-11.3 (-28.0; 5.4)	-0.2 (-16.9; 16.5)	-19.5 (-38.9; -0.2)*	-27.1 (-42.0; -12.2)***	-32.7 (-47.6; -17.8)***	-36.0 (-51.4; -20.7)***
Role-physical	-22.3 (-38.1; -	-10.0 (-25.8; 6.0)	-9.0 (-24.8; 7.0)	-19.5 (-37.9; -1.1)*	-40.0 (-54.1; -25.8)***	-26.7 (-40.8; -12.5)***	-26.0 (-40.5; -11.3)**

	6.5)**						
Bodily pain	-25.5 (-41.7; -9.4)**	-31.2 (-47.4; -14.9)***	-7.6 (-23.8; 8.6)	-35.0 (-53.8; -16.3)***	-32.9 (-47.3; -18.4)***	-31.8 (-46.3; -17.4)***	-38.8 (-53.7; -23.8)***
General health	-24.6 (-40.0; -9.3)**	-19.4 (-34.9; -3.9)*	-10.8 (-26.3; 4.6)	-29.8 (-47.7; -12.0)**	-26.3 (-40.1; -12.6)***	-43.5 (-57.3; -29.7)***	-37.4 (-51.6; -23.1)***
Vitality	-9.3 (-23.9; 5.3)	-0.3 (-14.4; -14.9)	-20.0 (-34.7; -5.4)**	-21.5 (-38.5; -4.6)*	-32.8 (-45.9; -19.8)***	-24.5 (-37.6; -11.5)***	-23.3 (-36.8; -9.8)**
Social functioning	-24.6 (-39.0; -10.3)**	3.2 (-11.2; 17.5)	-4.8 (-19.2; 9.5)	-14.2 (-30.9; 2.4)	-24.4 (-37.2; -11.6)***	-10.6 (-23.4; 2.3)	-21.5 (-34.7; -8.2)**
Role-emotional	-14.5 (-31.6; 2.7)	-19.9 (-37.1; -2.7)*	-15.5 (-32.7; 1.8)	-37.3 (-57.3; -17.4)***	-36.0 (-51.4; -20.7)***	-30.1 (-45.4; -14.7)***	-48.3 (-64.2; -32.4)***
Mental health	-28.7 (-44.9; -12.4)**	-7.8 (-24.2; 8.5)	-18.3 (-34.7; -2.0)*	-13.9 (-32.8; 5.0)	-33.0 (-47.5; -18.4)***	-26.8 (-41.4; -12.2)***	-19.6 (-34.7; -4.6)*

Multiple linear regression models after adjustment of the sociodemographic variables and lifestyle factors. b, beta estimator; CI, confidence interval. *P < 0.05, ** P < 0.01, *** P < 0.001

4. DISCUSSION

Generally, our study showed that obesity, hypertension, and diabetes (as separate cardiovascular factors and in combination) ~~affected negatively on~~ negatively affected all the physical and mental dimensions of HRQL, among our representative sample of the Saudi elderly population in the Eastern province of Saudi Arabia. The results of this study correspond to several global studies that have reported the negative impact of obesity, hypertension, and diabetes on the patients' HRQoL, as shown in Tables 5 and 6. In Sweden, the results of a cross-sectional study in three community health centers in Stockholm County showed a decrease and poor HRQoL in elderly diabetic subjects [14]. In central India, the results of a cross-~~control~~

sectional study in Medicine Outpatient department of a 780-bedded rural medical college showed a decrease and poor HRQoL in both the groups equally (diabetics and non-diabetic groups) [16]. In Netherland, a cross-sectional study showed that overweight and obesity are associated with impairment of quality of life [11]. In China, a cross-sectional study showed that hypertension impairs quality of life in terms of both physical and mental

health [13]. Furthermore, the results of our study correspond to several local studies that have reported the negative impact of obesity, hypertension, and diabetes on the patients' HRQOL. In Saudi Arabia, the results of a cross-sectional study in two health centers in the Eastern Province showed a moderate HRQoL among patients with type 2 diabetes [17]. Another previous cross-sectional study, which was conducted in Qassim region of Saudi Arabia, showed low self-perceived HRQoL in patients with type-2 DM [18]. In Al-Khobar area, a case-control study was conducted in PHC centers and showed that HRQoL in type 2 diabetic patients was lower ~~Than~~ than controls [23]. In Abha, a cross-sectional study showed that obese patients in nutrition and obesity clinics of the Aseer Central Hospital have poor HRQoL [22]. In Alkhober, the results of a case-control study in PHC centers showed that The QoL of hypertensive patients was substantially impaired in comparison to the control group.

In general, our study showed that a combination of cardiovascular factors, which included two-factor and three-factor clusters, in the female sample showed a greater decline in HRQoL than the separate cardiovascular factors (single-factor cluster), as shown in table 6. In contrast, the combination of factors in the male sample showed generally a less-than-expected reduction in HRQoL, as shown in table 5. Particularly, solely diabetes has a greater decline in most of HRQoL scale than the combination of obesity and hypertension, the combination of obesity and diabetes, and the combination of three factors. Possibly, this is because the sole diabetes sample has a large number of patients with other chronic diseases and risk factors burden such as smoking and physical inactivity. In addition, a sole diabetes sample has a high number of patients living alone. Several studies showed that living alone is associated with visit-to-visit HbA1c variability and an independent predictor of Type 2 diabetes in men, but not women, with type 2 diabetes [29, 30]. In female patients, our study generally showed that obesity and any combinations with obesity registered the worst HRQL on most of the scales in all-female clusters. Possibly, this is because the significant association of female gender with obesity and higher body dissatisfaction [31]. A previous study showed dissatisfaction seriously effects on the social, professional, and emotional obese women's self [32].

It was observed in our study that the female sample generally has a greater decline in physical functioning in most cardiovascular risk factors (including sole hypertension, obesity and hypertension, obesity and diabetes, and obesity, hypertension, and diabetes) than the male sample, as shown in tables 5 and 6. This greater decline in physical functioning could be associated with post-menopause women. A study showed that post-menopausal women have approximately greater limitations in physical functioning than pre-menopausal women which suggests that the physiology of menopause could lead to directly limitation in physical functioning [33]. Pathophysiological changes of the menopausal transition, which include an increased ratio of fat mass to lean mass [34], increased visceral fat [35], and bone mass loss [36], may lead to impairment, and functional limitation due to estrogen reduction. In addition, another study has shown that women have an accelerated decline in muscle strength around the time of menopause. In contrast, men have a gradual decline in muscle strength (specifically in isometric knee extension strength and handgrip strength) between 20 to 80 years old [37].

The results of our study also vary substantially even after adjusting lifestyles such as physical activity and smoking, by chronic diseases, and sociodemographic data suggesting that the association between obesity, hypertension, and diabetes as separated cardiovascular factors and in combination and the physical and mental dimensions of HRQL

could be explained by lifestyles such as physical activity, and smoking, by chronic diseases, and sociodemographic data, as shown in table 3-6. In Iran, The results of a cross-sectional study have shown ~~the~~ that current smokers had lower HRQoL than past and never smokers [38]. In England, The results of a cross-sectional study have shown that higher levels of physical activity are associated with better HRQoL [39].

Several limitations were noted in our study. It is an observational cross-sectional study. In addition, it shows only relationships, but that doesn't necessarily show causation. The comparison and citation to other studies should be considered, given the different methodological issues and the subjectivity of the surveys. In addition, study participants were included only from one province in Saudi Arabia, Eastern province, and can't be generalizable to other provinces in Saudi Arabia. Therefore, future studies can provide a useful understanding of the effect of obesity, hypertension, and diabetes on health-related quality of life among the elderly population in the different provinces in Saudi Arabia.

5. CONCLUSION

Our study showed that obesity, hypertension, and diabetes (as separate cardiovascular factors and in combination) affected negatively on all the physical and mental dimensions of HRQL, among our representative sample of the Saudi elderly population in the Eastern province of Saudi Arabia. In addition, the association between obesity, hypertension, and diabetes as separated cardiovascular factors and in combination and the physical and mental dimensions of HRQL could be explained by lifestyles such as physical activity, and smoking, chronic diseases, and sociodemographic data. In females, our study also showed that a combination of cardiovascular factors showed a greater decline in HRQL than the separate cardiovascular factors. In males, the combination of factors showed generally a less-than-expected reduction in HRQL. Obesity in old women and diabetes in old men are the worst factors in terms of adversely affecting the HRQL.

CONSENT

Informed consent was taken and obtained from the participants.

ETHICAL APPROVAL

This study was approved by research and ethics committee in Deanship of Scientific Research of King Faisal University (Al-Ahsa city, Saudi Arabia).

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