

# Lifestyle Behaviors, Subjective Health, and Quality of Life Among Chinese Men Living With Type 2 Diabetes

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Ghose Bishwajit, MPH, PhD<sup>1</sup>, Shangfeng Tang, PhD<sup>1</sup>,  
Sanni Yaya, PhD<sup>2</sup>, Zhifei He, PhD<sup>1</sup>, and Zhanchun Feng, PhD<sup>1</sup>

## Abstract

The aim of the present study was to investigate the association between self-reported health (SRH) and quality of life (QoL) with five lifestyle-related behaviors including tobacco smoking, drinking alcohol, physical activity status, consumption of fruits, and consumption of vegetables among men diagnosed with type 2 diabetes. Participants were 786 Chinese men older than 40 years and living in urban households. Cross-sectional data on self-rated health, associated sociodemographics, and health-related behaviors were collected from the Study on Global AGEing and Health (Wave 1) of World Health Organization. Results of multivariable regression reported significant association with adherence to healthy lifestyle behavior and SRH but not QoL. According to the results, percentage of men who reported being in good SRH was overwhelmingly high (95.9%) compared with good QoL (5%). Adherence to healthy behavior was strongly associated with SRH in both bivariate and multivariate analysis, adjusted odds ratio (95% confidence interval) of good SRH for nonsmokers: 1.276 [1.055, 2.773], nondrinkers: 1.351 [1.066, 3.923], taking physical exercise: 1.267 [1.117, 3.109], consuming at least five servings of fruits: 1.238 [1.034, 6.552], and vegetables: 1.365 [1.032, 3.885]. The current findings suggest that abstention from tobacco and alcohol, optimum consumption of fruits and vegetables, regular physical exercise could have marked impact on the health status of diabetic men.

## Keywords

Chinese men, healthy behavior, self-rated health, type 2 diabetes, quality of life

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## Introduction

Accumulating evidence suggests that the sharp increase in the prevalence of diabetes in low- to middle-income countries is largely a result of socioeconomic advancement that triggers lifestyles changes, for example, sedentary lifestyle, nutrition, and dietary transition (Bishwajit, 2015; Bishwajit, Ide, Hossain, & Safa, 2014; Popkin, 2015). During past two to three decades, China has experienced an economic boom at an unprecedented scale which has coincided with certain demographic and epidemiological shifts marked by rapid urbanization, change in diet pattern, rising prevalence of chronic noncommunicable diseases (NCDs) and sedentary lifestyle (Odegaard et al., 2011; Tang et al., 2015; Tang et al., 2016). The prevalence of diabetes in china has almost quadrupled over the course of past two decades (from 2.5% in 1997 to 9.7% in 2008; Chen & Yang, 2014). Apart from the changes in sociodemographic and lifestyle factors, the rising proportion of

elderly population is another major concern for controlling diabetes in the country. According to one estimate, by 2030, two third of the Chinese health burden is expected to occur in older adults (Chatterji et al., 2008). Elderly population currently represent 12% of the total population which is expected to increase threefold (about 34%) by 2050. The potential impacts of rising burden of diabetes and other NCDs include increased disability, worsening health-related quality of life (HRQoL), decreased labor productivity, tremendous amount of medical health care

<sup>1</sup>School of Medicine & Health Management, Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China

<sup>2</sup>School of International Development and Global Studies, University of Ottawa, Ontario, Canada

### Corresponding Author:

Ghose Bishwajit, Huazhong University of Science & Technology, 13 Hangkong Street, Wuhan 430030, China.  
Email: brammaputram@gmail.com



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expenditures, and associated socioeconomic costs (Ozieh, Bishu, Dismuke, & Egede, 2015; Valensi, Girod, Baron, Moreau-Defarges, & Guillon, 2005).

Results from epidemiological studies around the world indicate that lifestyle factors represent a considerable contributor to poor self-reported health (SRH) and HRQoL owing to NCDs. According to a World Health Organization (WHO) report, lifestyle factors predict about 60% of HRQoL among individuals (Ziglio, Currie, & Rasmussen, 2004). For instance, in 2000, 2.3% of all deaths were attributable to low fruit and vegetable intake (Ezzati et al., 2003). According to systematic review, increasing daily intake of vegetables could significantly reduce the risk of type 2 diabetes (Carter, Troughton, Khunti, & Davies, 2010). Other systematic reviews and meta-analyses reported significant association between both active and passive smoking (Y. Wang, Ji, Liu, Deng, & He, 2013; Willi, Bodenmann, Ghali, Faris, & Cornuz, 2007) and physical inactivity (Aune, Norat, Leitzmann, Tonstad, & Vatten, 2015) with type 2 diabetes. Evidence from local researches suggests that risk factors of type 2 diabetes are widely prevalent throughout China. In 2010, the prevalence of smoking was 28.1% with 52.9% of men and 2.4% of women (Li, Hsia, & Yang, 2011), accounting for 1.2 million death per year (Zhang, Ou, & Bai, 2011). In 2008, the prevalence of inadequate physical activity and tobacco smoking and were 10% and 26%, respectively (Chatterji et al., 2008). Prevalence of current and lifetime estimates of alcohol dependence are 2.2 and 3.7%, respectively (Cheng, Deng, Xiong, & Phillips, 2015). Prevalence of leisure-time physical activity is 28.9% for urban and 7.9% for rural residents (Paul et al., 2005). Though the lifestyle-related risk factors are becoming increasingly prevalent with gradual socioeconomic progress in China, the rising prevalence of NCDs like diabetes cannot not be regarded as inevitable consequences of the development process (Jamison et al., 2006).

Evidence from lifestyle intervention studies indicates that low rates of NCDs can be attained by behavioral modification, for example, cessation of smoking and drinking, regular physical exercises, and adopting healthier dietary habits (Chatterji et al., 2008; Harati, 2010; Kosaka, Noda, & Kuzuya, 2005). Importance of lifestyle intervention to decrease in the incidence of type 2 diabetes are reported in other Asian countries (Harati, 2010; Kosaka et al., 2005). A clinical trial among Japanese men reported a significant lowering of risk of diabetes by adopting regular physical exercise and dietary intervention (Kosaka et al., 2005). Led by these evidences, health care systems in many countries have been putting increasing emphasis on behavioral modification policies. The Chinese government headed *Healthy China 2020* program, which aims to making health care services accessible and affordable for all citizens, has an important

component to reduce NCDs by promoting healthy eating and active lifestyles. A major setback for designing and success of such programs is scarcity of quality data. In this study, Study on global AGEing and adult health (SAGE) data of WHO were used to this overcome this barrier with an aim to provide update on healthy behavior-related aspects and their association with physical health status among diabetic men. Male participants were chosen for the present study due the demonstrated difference in risk and behavioral patterns (Deeks, Lombard, Michelmore, & Teede, 2009), and the perception of health and illness across gender (Vlassloff, 2007). SRH was used as a measure of health status as it has become a frequently used tool in epidemiological research (Salomon, Nordhagen, Oza, & Murray, 2009) for its reliability as a predictor of mortality and morbidity in both population based and clinical studies (Shadbolt, Barresi, & Craft, 2002). SRH is recommended by WHO and the European Commission as an indicator of physical functioning and monitoring of health status in population studies (Salomon et al., 2009).

## Method

### *The Survey, Sampling, and Data Collection*

The SAGE by WHO aims to address scientific knowledge gap on ageing and health in low- and middle-income countries in Africa and Asia and other developing regions by providing reliable country representative survey data to aid in effective health policy making (Kowal et al., 2012). SAGE is a longitudinal study and the theme is health- and morbidity-related indicators among elderly population (50+ years) and a smaller proportions of younger population (18-49 years) for comparisons. Data for the present study were obtained from the most recent survey conducted during 2007 to 2010 (Wave 1; <http://www.who.int/healthinfo/sage/cohorts/en/index2.html>). For China, the survey duration was 2008 to 2010, and included both face-to-face and computer-assisted personal interview. Selection of the sampling strata consisted of three steps. For sampling, the 31 provinces in the country were divided into eastern, middle and western regions. At the second stage, four provinces were selected randomly from the eastern regions and two from the central and the western region each. Finally, one district from urban Death Surveillance Points and one county from rural Death Surveillance Points were selected in each province to include a total of 14,811 individuals for final interview. Response rate for Wave 1 was 93%. More details regarding the survey, sampling technique, and data distribution are available through the website. The SAGE program maintains a generous policy of providing the survey report and data sets to public on completion of

user agreement terms. Data for this study were collected by the first author through registration on SAGE website of WHO.

### Variables

The response variables were SRH and QoL. SRH is also known as Self-reported or Self-assessed health which is used as a reliable indicator of individual health status by public health researchers (Södergren, Sundquist, Johansson, & Sundquist, 2008). The advantages are that it is easy and inexpensive process and still serves as a powerful indicator of population health. For the SAGE study, respondents were asked “How satisfied are you with your health?” The possible answers on a 5-point Likert-type scale ranged from *very satisfied* through *very dissatisfied*. Answers ranging from *very satisfied* to *satisfied* were categorized as *good* SRH, and the rest as *not good* (Baruth, Becofsky, Wilcox, & Goodrich, 2014). QoL was measured by the responses of the following question: How would you rate your overall QoL? With answers ranging from *very good*, *good*, *moderate*, *bad*, to *very bad*. Similar to SRH, QoL was categorized as *good* (combining *very good* and *good*) and *not good* (combining *moderate*, *bad*, and *very bad*).

For the selection of independent variables, a literature review was conducted on PubMed to identify the associated sociodemographic variables. Depending on the availability of the variables on the SAGE data set, the following were included for analysis: age (categorized as 40-49, 50-59, 60+ years); marital status (currently married vs. currently unmarried); educational attainment (primary/under primary, high school, higher); self-reported earning status (inadequate vs. adequate); and living condition (satisfied vs. dissatisfied). For health-related behavior, the five independent variables included tobacco smoking, alcohol drinking, taking physical exercise on regular basis, eating fruits, and eating vegetables at least five servings a day (Carter et al., 2010).

### Data Analysis

Data were analyzed using STATA® version 12 and SPSS® version 21. Descriptive statistics were used to present the basic sociodemographic characteristics of the sample population. All the variables were entered as categorical and were presented as counts and percentages. Cross-tabulation with chi-square test was performed to explore the bivariate association between SRH status (*good* and *not good*) across the explanatory variables. Variables which were significant at  $p \leq .1$  were retained for regression analysis. Given the binary nature of the outcome variable, binary regression analysis (generalized estimating equations) were conducted to calculate odds

ratios and corresponding 95% confidence intervals while controlling for age, educational attainment, and marital status. Level of significance for all association was set at  $p < .05$  (two-tailed) and was considered statistically significant.

### Ethics Statement

SAGE surveys are approved by the WHO’s Ethical Review Committee. All participants gave written informed consent prior interview.

## Results

### Basic Characteristics

In total, 786 men were included in the analysis. Almost all the participants reported being in good health status ( $n = 753$ , 95.9%) and those who reported good QoL were remarkably low ( $n = 39$ , 5%). All the participants were residing in urban areas (not reported in the analysis). Table 1 indicates that more than a quarter were between 40 and 49 years of age ( $n = 682$ , 86.8%). A great majority of the men had high school level ( $n = 723$ , 92.0%) qualification and almost all reported being currently married ( $n = 774$ , 98.6%). Regarding income status, about two fifth ( $n = 323$ , 41.1%) of the participants reported their level of earning as inadequate. Regarding household characteristics, more than four-fifth men were said they were satisfied with their living condition ( $n = 641$ , 81.6%). Regarding health behavior, the percentage of currently smoking, alcohol drinking, and taking physical exercise were 7.3 ( $n = 57$ ), 6.2 ( $n = 48$ ), and 12.7% ( $n = 100$ ), respectively. Only 2.9% ( $n = 22$ ) men reported consuming at least five servings of fruits and 10.1% ( $n = 79$ ) consuming at least five servings of vegetables on daily basis.

Results of cross-tabulation indicate that men who reported their health status and QoL as good are more likely to be between 40 and 49 years of age, having high school-level qualification, and currently married. Those who reported having adequate income and satisfaction with living condition were more likely to express being in good health status. The likelihood of self-rated good health was also higher among nonsmokers, nondrinkers, and those who take physical exercise and consumed more than five servings of fruits and vegetables per day.

Table 2 presents the percentage of sample population who reported adherence to five types of health-related behavior. Abstinence from alcohol and consumption of fruits and vegetables were highest among men older than 60 years. Those who had high school qualification and were currently married reported highest rate of adherence to all the health-related behaviors. Groups expressing

**Table 1.** Basic Sociodemographic and Health Behavior–Related Characteristics of the Study Population (N = 786).

Variable	n (%)	Self-rated health		QoL	
		Good (95.9%), n (%)	p	Good (5%), n (%)	p
Age (years)			<.0001		<.0001
40-49	682 (86.8)	681 (90.3)		682 (91.3)	
50-59	26 (3.3)	13 (1.7)		16 (2.1)	
60+	78 (9.9)	60 (8.0)		49 (6.6)	
Educational attainment			<.0001		<.0001
Primary/under primary	32 (4.1)	27 (3.6)		18 (2.4)	
High school	723 (92.0)	704 (93.4)		709 (94.9)	
Higher	31 (3.9)	23 (3.1)		20 (2.7)	
Marital status			.07		<.0001
Currently married	775 (98.6)	745 (98.8)		741 (99.2)	
Currently unmarried	11 (1.4)	9 (1.2)		6 (0.8)	
Earning status			.445		.243
Inadequate	323 (41.1)	309 (41.0)		140 (18.7)	
Adequate	463 (58.9)	445 (59.0)		607 (81.3)	
Living condition			.128		.434
Satisfied	641 (81.6)	612 (81.2)		439 (58.8)	
Dissatisfied	145 (18.4)	142 (18.8)		308 (41.2)	
Smokes tobacco			<.0001		<.0001
Yes	57 (7.3)	43 (5.7)		47 (3.5)	
No	729 (92.7)	711 (94.3)		712 (95.3)	
Drink alcohol			<.0001		<.0001
Yes	49 (6.2)	34 (4.5)		32 (4.3)	
No	737 (93.8)	720 (95.5)		715 (95.7)	
Takes PA					
Yes	686 (87.3)	685 (90.8)		682 (91.3)	
No	100 (12.7)	69 (9.2)		65 (8.7)	
Consumption of fruits			<.0001		<.0001
<5 Servings/day	763 (97.1)	736 (97.6)		731 (97.9)	
>5 Servings/day	23 (2.9)	18 (2.4)		16 (2.1)	
Consumption of vegetables			.004		<.0001
<5 Servings/day	707 (89.9)	699 (92.7)		701 (93.8)	
>5 Servings/day	79 (10.1)	55 (7.3)		46 (6.2)	

Note. PA = physical activity; QoL = quality of life. p Value from chi-square tests.

satisfaction with earning status and living condition also had better adherence to healthy behavioral pattern except for consumption of fruits and vegetables.

### Results of Logistic Regression Analysis

The association between SRH and explanatory variables were examined using Pearson's chi-square test of independence. Variables which reported significance at  $p \leq .1$  were retained for regression analysis. Hosmer–Lemeshow goodness-of-fit statistic was conducted and the value was 0.632 ( $p > .05$ ), which reported good model calibration. Results of the multiple regression analysis illustrates that SRH was significantly associated with adherence to healthy lifestyle behavior. Those who did not smoke tobacco and consume alcohol had 28% and 35% higher

odds of reporting good SRH compared with the reference group (smokers and drinkers). Regular engagement in physical exercise also increased the likelihood of good SRH by 27%. The odds of good SRH were 24% and 37% higher among men who consumed at least five servings of fruits and vegetables per day.

### Discussion

Based on analysis of the WHO's SAGE survey data (Wave 1), the present study attempted to demonstrate the association between adherence to healthy behavior and self-rated health among men with type 2 diabetes (Table 3). The findings reveal that for all five types of health-related behaviors, men who reported adhering to healthy behaviors also were also more likely to report good SRH and

**Table 2.** Percentage of Adherence to Self-Management Behavior in the Study Population, SAGE I, 2007 to 2010.

Variables	Nonsmoker, n (%)	Abstain from alcohol, n (%)	Takes PA, n (%)	Consumption of fruits, n (%)	Consumption of vegetables, n (%)
Age (years)					
40-49	681 (93.4)	—	680 (99.1)	1 (4.3)	2 (2.5)
50-59	11 (1.5)	10 (20.4)	—	4 (17.4)	21 (26.6)
60+	37 (5.1)	39 (79.6)	6 (0.9)	18 (78.3)	56 (70.9)
Educational attainment					
Primary/under primary	15 (2.1)	12 (24.5)	2 (0.3)	4 (17.4)	19 (24.1)
High school	699 (95.9)	19 (38.8)	682 (99.4)	9 (39.1)	35 (44.3)
Higher	15 (2.1)	18 (36.7)	2 (0.3)	10 (43.5)	25 (31.6)
Marital status					
Currently married	725 (99.5)	45 (91.8)	685 (99.9)	21 (91.3)	72 (91.1)
Currently unmarried	4 (0.5)	4 (8.2)	1 (0.1)	2 (8.7)	7 (8.9)
Earning status					
Satisfied	429 (58.8)	27 (55.1)	404 (58.9)	14 (60.9)	69 (87.3)
Dissatisfied	300 (41.2)	22 (44.9)	282 (41.1)	9 (39.1)	10 (12.7)
Living condition					
Satisfied	592 (81.2)	43 (87.8)	553 (80.6)	3 (13.0)	323 (41.1)
Dissatisfied	137 (18.8)	6 (12.2)	133 (19.4)	20 (87.0)	463 (58.9)

Note. SAGE = Study on global AGEing and adult health; PA = physical activity.

**Table 3.** Association Between Self-Rated Health and Adherence to Healthy Behavior Among Chinese Men With Diabetes, SAGE 2007 to 2010.

Variables	<i>p</i>	COR [95% CI]	<i>p</i>	AOR [95% CI]
Tobacco				
Smoker	—	—	—	—
Nonsmoker	.001	1.784 [1.113, 2.859]	.001	1.276 [1.055, 2.773]
Alcohol				
Drinker	—	—	—	—
Nondrinker	.001	2.109 [1.113, 2.979]	.001	1.351 [1.066, 3.923]
PA				
Active	—	—	—	—
Inactive	.121	1.229 [0.529, 2.853]	.001	1.267 [1.117, 3.109]
Consumption of fruits				
<5 Servings/day	—	—	—	—
>5 Servings/day	.001	1.833 [0.620, 5.423]	.001	1.238 [1.034, 6.552]
Consumption of vegetables				
<5 Servings/day	—	—	—	—
>5 Servings/day	.43	1.429 [0.357, 5.724]	.031	1.365 [1.032, 3.885]

Note. SAGE = Study on global AGEing and adult health; CI = confidence interval; COR = crude odds ratio; AOR = adjusted odds ratio (adjusted for age, educational status, marital status); PA = physical activity.

QoL. Having high school-level qualification and perception of adequate income level also increased the likelihood of being in good SRH and QoL. Findings further indicate that adherence to healthy behaviors were significantly associated with self-rated health. However, the association was not significant for QoL (Table 4).

In epidemiological researches, subjective health has been used extensively a reliable and important indicator

of physical and mental health of individuals/communities. The association between SRH and physical functioning is well documented in population-based samples (Badawi, Gariépy, Pagé, & Schmitz, 2012). While previous studies have provided evidence on the impact of healthy lifestyle on preventing the development of type 2 diabetes, the focus of the present was on the population already living with diabetes.

**Table 4.** Association Between Self-Reported Quality of Life and Adherence to Healthy Behavior Among Chinese Men With Diabetes, SAGE 2007 to 2010.

Variables	<i>p</i>	COR [95% CI]	<i>p</i>	AOR [95% CI]
Tobacco				
Smoker	—	—	—	—
Nonsmoker	.123	2.068 [0.822, 5.200]	.739	1.165 [0.474, 2.866]
Alcohol				
Drinker	—	—	—	—
Nondrinker	.202	0.549 [0.218, 1.380]	.844	1.096 [0.441, 2.723]
PA				
Active	—	—	—	—
Inactive	.009	9.134 [1.74, 47.78]	.150	0.259 [0.041, 1.630]
Consumption of fruits				
<5 Servings/day	—	—	—	—
>5 Servings/day	.347	0.595 [0.202, 1.754]	.375	0.609 [0.204, 1.823]
Consumption of vegetables				
<5 Servings/day	—	—	—	—
>5 Servings/day	.001	9.607 [2.56, 36.02]	.030	3.375 [1.127, 10.110]

Note. SAGE = Study on global AGEing and adult health; CI = confidence interval; COR = crude odds ratio; AOR = adjusted odds ratio (adjusted for age, educational status, marital status); PA = physical activity.

This study also recognizes the scarcity of similar country-representative research evidence for men or the general population. One Canadian study (Montreal) also reported the factors of association with SRH among diabetic patients; however, it focused on both men women and included a broader set of variables (Badawi et al., 2012). Compared with the Badawi et al.'s (2012) study, the proportion of participants who reported being in good health status were remarkably high (78% in the general population vs. 95.9% among men) in the present study. One possible reason for this marked difference can be attributed to inclusion of participants with depression and physical disability in the Canadian study which are expected to adversely affect subjectively health status. Second, as the sample included only urban sample, so a higher rate of good health status can be explained by better living and socioeconomic conditions and availability of advanced health care facilities.

A large volume of behavioral intervention studies exist which support the direct impact of unhealthy behavior to onset of type 2diabetes (Abu-Omar, Rütten, & Robine, 2004; Valencia-Martín, Galán, & Rodríguez-Artalejo, 2009), while some studies conclude that the behavioral risk factors themselves do not contribute to SRH, but by the mediating consequences of more specific health problems (Manderbacka, Lundberg, & Martikainen, 1999). The potential conflict is understandable by the fact that SRH is a truly multidimensional construct which is certainly affected by individual health behaviors, plus a multitude of sociocultural and economic factors that can influence the perception of health and well-being among individuals (Baruth et al., 2014).

Despite that, behavior modification strategies have produced promising outcomes on the NCDs prevention and intervention programs across countries. In line with finding from many previous researches on general population, the present study identified a strong impact of healthy behavior on SRH among diabetic men as well. A recent study conducted on secondary schools students in Hong Kong reported smoking to be significantly associated with poor SRH (M. P. Wang, Ho, Lo, Lai, & Lam, 2012), replicating the results from two large scale studies on American adults for SRH (Arday et al., 2003) and HRQoL (McClave, Dube, Strine, & Mokdad, 2009). Studies on the impact of alcohol consumption on SRH have been increasing constantly, but results remain mixed across regions. A Longitudinal Study of Ageing on English sample reported no evidence of association between alcohol consumption and SRH (Fisher et al., 2015), which is similar to the finding from a Mediterranean study which reported occasional, moderate, and excessive drinking to be ameliorative of SRH (Valencia-Martín, 2009). However, studies on binge drinking and alcohol abuse reported considerable declines in SRH in both regions (Tsai, Ford, Li, Pearson, & Zhao, 2010. Valencia-Martín, 2009). Similar inconsistencies exist regarding the impact of physical activity on SRH across regions. Significant associations were observed between higher levels of exercise and good SRH among African American (Baruth et al., 2014) and Swedish population (Södergren et al., 2008), but another study encompassing 15 member states of the European Union produced mixed results (Abu-Omar et al., 2004). Regarding the fruits and vegetables consumption, the

results are consistent with findings from a longitudinal study from the Canadian National Population Health Survey (2002/03-2008/09) reporting that high fruit and vegetable consumption had a beneficial influence on SRH among Canadian adolescents (Yuriko & Norito, 2013). However, among African Americans, fruit and vegetable consumption did not have any association with SRH (Baruth et al., 2014).

This study has some important strengths and limitations to note. Data were collected from a country-representative sample and included large sample on older adults which is usually hard to carry out. Use of subjective health status gave the measurement a higher reliability of men's health status. As a downside, only urban men were included in the analysis due to very low proportion of sample from rural areas. The study being cross-sectional in nature is unable to make any causal inferences. Since data were secondary, researchers had no control over the selection and measurement of variables. Health-related behaviors were measured based on patients' report which is subject to recall bias and overreporting/underreporting. As diagnosis of diabetes was self-reported, some nondifferential misclassification are expected to be present which might have affected the estimates of the associations. Last but not least, the sample population included men of above 40 years of age only, and hence not representative of the entire male population in the country.

## Conclusion

The present study reported the association between adherence to healthy behavior and self-rated health among a representative sample of diabetic men in China older than 40 years. Results illustrate that nonadherence to healthy behavior was associated with poor SRH but not QoL, and support previous findings by reporting the benefits of maintaining a healthy lifestyle for better SRH status among men living with diabetes. This study recommends that future studies should focus on more in-depth analysis by including a wide-ranging variables to explore the underlying causes of nonadherence to healthy behavior among diabetic patients.

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