Effect of Body Weight on Pattern of Coronary Lesions in Patients Undergoing Coronary Angiography at Sohag University Hospital

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ABSTRACT

Background: Obesity is related to multiple risk factors of cardiovascular disease (CVD) including hypertension, diabetes mellitus (DM), metabolic syndrome, and dyslipidemia, while also likely being an independent risk factor for CVD. Through multiple pathways including increased angiotensin, circulating blood volume, and total peripheral resistance, excess weight increases hypertension (HTN) risk.

Objective: This study aimed to reveal the relationship between body weight and the severity of coronary artery disease (CAD) in patients referred for coronary angiography at Sohag University Hospital.

Patients and methods: This was a cross-sectional hospital-based study performed on 200 patients, at Sohag University Hospital. Mean age was 56.94 ± 10.30 years. Among them, there were 175 patients (87.5%) who were overweight or obese with higher prevalence of HTN, hyperlipidemia, and diabetes. Normal weight patients were 25 (12.5%) with lower prevalence of HTN, hyperlipidemia, and diabetes.

Results: According to BMI in our study, 175 patients (87.5 %) were overweight or obese, 162 patients (92.57%) of the overweight had significant coronary artery disease. 162 patients (81%) had significant coronary angiography findings (> 70% stenosis in any of the coronary arteries). They were classified to 63 patients (31.5%) had single vessel diseased, 53 patients (26.5%) had two vessels diseased, and 46 patients (23%) had three vessels diseased.

Conclusion: Obesity, diabetes, hypertension, hyperlipidemia, aging and male gender were correlated with severity of CAD. Thus, reduction of weight, stoppage of smoking and control of diabetes, hypertension and hyperlipidemia will improve outcome of coronary artery disease.

Keywords: Body weight, Coronary lesions, Coronary angiography, Obesity.

INTRODUCTION

Obesity is an independent risk factor for cardiovascular disease (CVD), and is associated with advanced CVD that is associated with percutaneous coronary intervention (PCI), reduction in life expectancy, and a higher mortality rate. Weight loss has been associated with improvement in pre-existing cardiovascular risk factors including hypertension (HTN), diabetes, and dyslipidemia and mortality [1]. Obesity is an accepted risk factor for CAD. Therefore, it may be assumed that obese patients have poorer outcomes than non-obese patients [2].

Some studies have reported improved clinical outcomes in overweight and obese patients treated for CVDs compared to normal weight patients, suggesting a paradoxical survival benefit. This effect has been reported in patients with diabetes, end-stage renal disease, HTN, and other conditions traditionally associated with poorer outcomes. Obesity was primarily measured using BMI. The mechanisms leading to this phenomenon, termed "obesity paradox," are unclear [3, 4]. The quantification of coronary artery disease (CAD) severity can be captured using coronary angiography (CA). Historically CAD has been categorized as single, double, and triple vessel and left main disease, with luminal stenosis of either ≥ 50% (left main) or ≥ 70% (other major epicardial vessels) used to define significance [5].

Patients are classified into three categories according to BMI using the World Health Organization classification system: normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese class (> 30 kg/m^2) [6].

The pathogenesis of obesity and atherosclerosis has several common factors. In both cases, lipids, oxidized LDL particles, and free fatty acids activate the inflammatory process and trigger the disease. Inflammation is responsible for all the steps towards atherosclerosis, from early endothelial dysfunction to the atherosclerotic plaques causing complications, and is related to obesity, insulin resistance, and type 2 diabetes. The fatty tissue releases adipocytokines, which induce insulin resistance, endothelial dysfunction, hypercoagulability, and systemic inflammation, thereby facilitating the atherosclerotic process [7].

A 10 kg rise in body weight increases the risk of coronary artery disease by 12% and at the same time, systolic blood pressure rises by 3 mmHg and diastolic by 2.3 mmHg as a consequence [8].

This study was conducted to reveal the relationship between body weight and the severity of coronary artery disease in patients referred for coronary angiography at Sohag University Hospital.

PATIENTS AND METHODS

This was a cross-sectional hospital-based study performed on 200 patients, at Sohag University Hospital-Catheter Lab. Unit.

Inclusion criteria: All patients with coronary artery disease undergoing coronary angiography.

Exclusion criteria: All patients with history of CABG

or PCI (Since the focus of the study will be on patients with suspected but not yet confirmed CAD).

All patients were subjected to the following:
1) Full history taking including age, sex, occupation, smoking, exercise, history of diabetes or hypertension and family history of ischemic heart disease.
2) Full clinical examination including weight, height, BMI, waist circumference, skin thickness of the arm, arterial blood pressure and peripheral pulsation.
3) Laboratory investigations including lipid profile, serum creatinine and blood sugar.
4) Electrocardiogram.
5) Echocardiography (using Toshiba, Aplio i900).
6) Coronary angiography (CA).

All patients were hospitalized at Sohag University Hospital- Cath. Lab. Unit. They were screened for overweight and obesity by measuring height, weight, and calculating body mass index (BMI) as part of the routine physical examination. In addition, waist circumference was measured.

Body mass index: Measuring BMI was the generally accepted first step to determine the degree of overweight. The BMI is easy to measure, reliable, and correlated with percentage of body fat and body fat mass. BMI has provided a better estimate of total body fat compared to body weight alone [9].

Calculation of BMI: The BMI is the most practical first step for evaluating the degree of excess weight. It is calculated from the weight and square of the height as follows:

 BMI = body weight (in kg) ÷ height (in meters) squared.

BMI-based classifications: Body mass index (BMI) classifications are based upon risk of cardiovascular disease (CVD) [10]. The recommended classifications for BMI adopted by World Health Organization (WHO) [6] for Caucasian, Hispanic, and black individuals are:
Underweight: < 18.5 kg/m^2.
Normal weight: ≥ 18.5 to 24.9 kg/m^2.
Overweight: ≥ 25.0 to 29.9 kg/m^2.
Obesity: ≥ 30 kg/m^2.
• Class I: 30.0 to 34.9 kg/m^2.
• Class II: 35.0 to 39.9 kg/m^2.
• Class III: ≥ 40 kg/m^2 (also referred to as severe, extreme, or massive obesity).

Waist circumference: Waist circumference is a measurement of abdominal obesity and provides independent risk information that is not accounted for by BMI [11]. In addition to measuring BMI, we suggested measuring waist circumference in overweight and obese adults to assess abdominal obesity. A waist circumference of $\geq$ (102 cm) for men and $\geq$ (88 cm) for women; were considered elevated and indicative of increased cardio-metabolic risk [12].

Coronary angiography (Assessment for coronary artery atherosclerotic disease)**:** The diagnostic procedure was performed by an experienced interventional cardiologist [using Toshiba infinix CV-I Apparatus Model 2004 (Seldinger's technique)] via right femoral artery after performing local anesthesia with xylocaine.

Patients were grouped according to BMI categories using the World Health Organization classification system into three groups: normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese class (> 30kg/m^2) [6]**.**

Ethical consideration:
 The study was aproved by Scientific and Ethical Committees of Sohag Faculty of Medicine. An informed written consent was obtained from every patient. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis
 Data were analyzed using STATA version 14.2 (Stata Statistical Software: Release 14.2 College Station, TX: Stata Corp LP.). Quantitative data were represented as mean, standard deviation, median and range. Data was analyzed using ANOVA for comparison of the means of three groups or more with post-hoc Bonferroni test. When the data were not normally distributed Kruskal Wallis test for comparison of three or more groups. Mann-Whitney test was used to compare two groups. Qualitative data was presented as number and percentage and compared using either Chi square test or fisher exact test. Graphs were produced by using Excel or STATA program. P value was considered significant if it was equal or less than 0.05.

RESULTS
- Among 200 patients, 114 patients (57%) were males and 86 patients (43%) were females and mean age was 56.94 ± 10.30 years (Table 1).
- **Regarding the risk factors**, 111 patients (55.50%) were diabetic, 127 patients (63.50%) were hypertensive, 107 patients (53.50%) had history of smoking and 12 patients (6%) had family history of IHD (Table 2).
- Regarding the risk of hyperlipidemia (patients with LDL level > 70 mg/dl were considered uncontrolled, all patients were under treatment of statins), 40 patients (20%) were controlled and 160 patients (80%) were uncontrolled (Table 3).
- Regarding BMI, 175 patients (87.5 %) were overweight or obese: 25 patients (12.5%) had normal BMI, 82 patients (41%) had a BMI indicating overweight and 93 patients (46.5%) were classified as obese. According to waist circumference, 24 patients (12.00%) were classified as normal waist circumference and176 patients (88.00%) were classified as increased waist circumference (central obesity) (Table 4).
- **According to coronary angiography** (number of vessels diseased), patients were classified according to number of vessels affected into 4 groups, normal group,

single vessel diseased group, two vessels diseased group and three vessels diseased group. 38 patients (19%) had normal angiogram or noncritical (< 70%) stenosis in any of the coronary arteries, 63 patients (31.50%) had single vessel diseased, 53 patients (26.50%) had two vessels diseased and 46 patients (23%) had three vessels diseased (Table 5).

Table (1): Age and gender of studied population

Variable	Summary statistics
Age / year Mean ± SD Median (range)	56.94 ± 10.3 57 (25:87)
Gender Females Males	86 (43%) 114 (57%)

Table (2): Medical history of studied population

Variable	Summary statistics
DM No Yes	89 (44.5%) 111 (55.5%)
Hypertension No Yes	73 (36.5%) 127 (63.5%)
Smoking No Yes x-smoker	93 (46.5%) 92 (46%) 15 (7.5%)
Family history IHD No Yes	188 (94%) 12 (6%)

Table (3): Distribution of studied population according to hyperlipidemia

Hyperlipidemia (according level of LDL)	Number (%)
Controlled	40 (20%)
Uncontrolled	160 (80%)

Table (4): Anthropometric measures of studied population

Variable	Summary statistics
Waist circumference (cm) Mean ± SD Median (range)	103.86 ± 5.62 105 (85:114)
Waist circumference(cm) Normal Abnormal	24 (12%) 176 (88%)
BMI Mean ± SD Median (range)	29.52 ± 3.10 29.74 (21.13:36.79)
BMI group Normal weight Overweight Obese	25 (12.5%) 82 (41%) 93 (46.5%)

Table (5): Number of affected vessels by angiography

Number of vessels	Summary statistics
None	38 (19%)
One	63 (31.5%)
Two	53 (26.5%)
Three	46 (23%)

According to risk factors, the 25 normal weight patients were classified to 7 diabetic patients (28%), 13 hypertensive patients (52%) and 1 patients (4%) with family history of IHD. Regarding risk of hyperlipidemia, there were 24 patients with controlled level of LDL. The 82 overweight patients were classified to 30 diabetic patients (36.59%), 45 hypertensive patients (54.88%) and 7 patients (8.54%) with family history of IHD. Regarding hyperlipidemia, there were 66 patients (80.49%) with uncontrolled level of LDL. The 93 obese patients were classified into 74 diabetic patients (79.57%), 69 hypertensive patients (74.19%) and 4 patients (4.3%) with family history of IHD. Besides, all obese patients had uncontrolled level of LDL (Tables 6 & 7).

Table (6): Relation between BMI and medical history

Variable	Normal weight N=25	Overweight N=82	Obese N=93	P value
DM No Yes	18 (72%) 7 (28%)	52 (63.41%) 30 (36.59%)	19 (20.43%) 74 (79.57%)	<0.0001
P1=0.43, P2<0.0001, P3<0.0001				
Hypertension No Yes	12 (48%) 13 (52%)	37 (45.12%) 45 (54.88%)	24 (25.81%) 69 (74.19%)	0.01
P1=0.80, P2=0.03, P3=0.01				
Family history of IHD No Yes	24 (96%) 1 (4%)	75 (91.46%) 7 (8.54%)	89 (95.7%) 4 (4.3%)	0.45
P1=0.45, P2=0.95, P3=0.25				

P value compared the three group, P1 compared normal weight with overweight, P2 compared normal weight with obese, and P3 compared overweight with obese

Table (7): Relation between hyperlipidemia and BMI

BMI	Controlled Hyper-lipidemia N=40	Uncontrolled Hyper-lipidemia N=160	P value
Normal weight	24 (96%)	1 (4%)	<0.0001
Overweight	16 (19.51%)	66 (80.49%)	
Obese	0	93 (100%)	

Data was presented as row percentage

Regarding BMI and coronary angiography results, The 25 (normal weight) patients, 100% were assigned to normal coronary angiography or non-significant coronary artery stenosis. The 82 (overweight) patients were classified into13 patients (15.85%) who had normal coronary angiography or non-significant coronary artery stenosis, 41 patients (50%) who had single vessel diseased, 17 patients (20.73%) who had two vessels diseased and 11 patients (13.41%) who had three vessels diseased. The 93 (obese) patients were classified into 22 patients (23.66) who had single vessel diseased, 36 patients (38.71%) who had two vessels diseased and 35 patients (37.63%) who had three vessels diseased (Table 8).

Table (8): Relation between BMI and number of Vessels affected

Number of vessels	Normal weight N=25	Overweight N=82	Obese N=93	P value
None	25 (100%)	13 (15.85%)	0	
One	0	41 (50%)	22 (23.66%)	<0.0001
Two	0	17 (20.73%)	36 (38.71%)	
Three	0	11 (13.41%)	35 (37.63%)	
P1<0.0001, P2<0.0001, P3<0.0001				

P value compared the three group, P1 compared normal weight with overweight, P2 compared normal weight with obese, and P3 compared overweight with obese

Regarding the relation between coronary angiography results and risk factors (age gender and hyperlipidemia) (Tables 9, 10, and 11).

The 200 patients were classified into: 38 patients (19%) had normal angiogram or noncritical (< 70%) stenosis in any of the coronary arteries. They were classified into 20 females (52.63%) and 18 males (47.37%) with mean age of 54.79 ± 10.17 years. 11 diabetic patients (28.95%), 21 hypertensive patients (55.26%), 16 patients (42.10%) with history of smoking and one patient (2.63%) with family history of IHD. Regarding hyperlipidemia, 33 patients (94.74%) had controlled level of LDL and 5 patients (5.26%) had uncontrolled level of LDL.

Concerning number of vessels affected: 63 patients (31.5%) who had single vessel diseased were classified into 24 females (38.10%) and 39 males (61.90%) with mean age of 56.94 ± 9.78 years. There were 31 diabetic patients (49.21%), 39 hypertensive patients (61.90%), 35 patients (55.56%) with history of smoking and two patients (3.17%) with family history of IHD**.** Regarding hyperlipidemia, 7 patients (17.5%) had controlled level of LDL and 56 patients (82.5%) had uncontrolled level of LDL.

53 patients (26%) who had two vessels diseased were classified into19 females (35.85%) and 34 males (64.15%) with mean age of 57.23 ± 11.36 years. There were 37 diabetic patients (69.81%), 34 hypertensive patients (64.15%), 33 patients (62.26%) with history of smoking and 7 patients (13.21%) with family history of IHD. Regarding hyperlipidemia, all of them had uncontrolled level of LDL.

46 patients (23%) who had three vessels diseased were classified into 23 females (50.00%) and 23 males (50.00%) with mean age of 58.37 ± 8.55years. there were 32 diabetic patients (69.57%), 33 hypertensive patients (71.74%), 23 patients (50.00%) with history of smoking and 2 patients (4.35%) with family history of IHD. Regarding hyperlipidemia, all of them had uncontrolled level of LDL.

Table (9): Relation between number of blood vessels affected and age & gender

Variable	None (N=38)	One (N=63)	Two (N=53)	Three (N=46)	P value
Age / year Mean ± SD Median (range)	54.79 ± 10.17 54 (25:80)	56.94 ± 9.78 58 (32:80)	57.23 ± 11.36 58 (35:87)	58.37 ± 8.55 58 (39:83)	0.44
P1=1.00, P2=1.00, P3=0.6, P4=1.00, P5=1.00, P6=1.00					
Gender Females Males	20 (52.63%) 18 (47.37%)	24 (38.1%) 39 (61.9%)	19 (35.85%) 34 (64.15%)	23 (50%) 23 (50%)	0.25
P1=0.15, P2=0.11, P3=0.81, P4=0.80, P5=0.22, P6=0.16					

P value compared the four group, p1 compared none with one, p2 none with two, p3 none with three, p4 one with two, p5 one with three, p6 two with three.

Table (10): Relation between number of blood vessels affected and medical history

Variable	None N=38	One N=63	Two N=53	Three N=46	P value
DM					
No	27 (71.05%)	32 (50.79%)	16 (30.19%)	14 (30.43%)	<0.0001
Yes	11 (28.95%)	31 (49.21%)	37 (69.81%)	32 (69.57%)	
P1=0.045, P2<0.0001, P3<0.0001, P4=0.03, P5=0.03, P6=0.98					
Hypertension					
No	17 (44.74%)	24 (38.1%)	19 (35.85%)	13 (28.26%)	0.47
Yes	21 (55.26%)	39 (61.9%)	34 (64.15%)	33 (71.74%)	
P1=0.51, P2=0.39, P3=0.12, P4=0.80, P5=0.28, P6=0.42					
Smoking					
No	22 (57.89%)	28 (44.44%)	20 (37.74%)	23 (50%)	0.36
Yes	15 (39.47%)	28 (44.44%)	30 (56.6%)	19 (41.3%)	
X-smoker	1 (2.63%)	7 (11.11%)	3 (5.66%)	4 (8.7%)	
P1=0.21, P2=0.16, P3=0.46, P4=0.34, P5=0.82, P6=0.31					
Family history					
No	37 (97.37%)	61 (96.83%)	46 (86.79%)	44 (95.65%)	0.08
Yes	1 (2.63%)	2 (3.17%)	7 (13.21%)	2 (4.35%)	
P1=1.00, P2=0.13, P3=1.00, P4=0.08, P5=1.00, P6=0.17					

P value compared the four group, p1 compared none with one, p2 none with two, p3 none with three, p4 one with two, p5 one with three, p6 two with three.

Table (11): Relation between hyperlipidemia and number of blood vessels affected

Number of affected vessels	No hyperlipidemia N=40	Hyperlipidemia N=160	P value
None	33 (82.5%)	5 (3.13%)	
One	7 (17.5%)	56 (35%)	<0.0001
Two	0	53 (33.13%)	
Three	0	46 (28.75%)	

DISCUSSION

Our study examined the relationship between BMI and CAD in patients undergoing CA for suspected, but not yet confirmed CAD.

Our study was performed on 200 patients with mean age of 56.94 ± 10.30 years. Among them, 175 patients (87.5%) were overweight or obese with higher prevalence of HTN, hyperlipidemia, and diabetes. Normal weight patients were 25 (12.5%) with lower prevalence of HTN, hyperlipidemia, and diabetes. These findings are supported by the study of **Labounty et al.** [13]. The relationship between obesity and prevalence of diabetes, systemic hypertension and hyperlipidemia was also reported by **Labounty et al.** [13] who mentioned that a higher BMI was independently associated with increased risk of MI. In the current study we found strong relation between obesity and the modifiable risk factors of CAD (diabetes, systemic hypertension and hyperlipidemia).

Obesity is an independent risk factor for both DM and Metabolic Syndrome, with the prevalence of DM being closely related to the rise in obesity [14]. The Behavioral risk Factor Surveillance System demonstrated that the prevalence of DM increased 33% throughout follow up, a rise related with increasing rates of obesity [15]. DM increases the risk of CAD through its association with endothelial dysfunction and dyslipidemias, both initial steps in the atherogenic process. Through these mechanisms, DM is one of the strongest CAD risk factors, characterized by very high 10-year risk of CV events [16].

All patients in our study; underwent coronary angiography at Sohag University Hospital-Cath. Lab. Unit. By comparison between findings of coronary angiography and the BMI of all patients, we found that 175 patients (87.5 %) were overweight or obese, 162 patients (92.57%) of them had significant coronary artery disease. Also, 162 patients (81%) had abnormal significant coronary angiography findings (> 70% stenosis in any of the coronary arteries) where they were classified into 63 patients (31.5%) had single vessel diseased, 53 patients (26.5%) had two vessels diseased, and 46 patients (23%) had three vessels diseased. Similar study by **Gregory et al.** [17] compared between CAD and obesity. It was performed on 8079 patients in Memorial University of New foundland, St. John's, NL, Canada 2017. There were 6782 patients (83.95%) who were overweight or obese; 3898 patients (57.48%) of them had significant coronary artery disease.

Regarding male gender as a risk factor for CAD in our study, we found that there were 114 male patients in our study; 96 of them (84.21%) had significant coronary artery disease varied from single vessel to three vessels diseased. In contrast of female gender, there were 86 female patients, 66 of them (76.744%) had significant coronary artery disease, almost of them were post-menopause. In study of **Gregory et al.** [17], there were 4669 patients (57.79%) who had significant coronary

artery disease, 5074 were male patients (62.8%). In study of **Baghbani-Oskouei et al.** [18], there were 185 patients of significant coronary artery disease, 123 patients (66.5%) were males. From the results above, we found increase in prevalence of CAD in male patients.

Regarding aging as a risk factor for CAD in our study, we found that the mean age of 200 patients was 56.94 ± 10.30 years and there were 162 patients (81%) who had significant coronary artery disease. This is in agreement with **Gregory et al.** [17] who reported that the mean age of 8079 patients was 61.2 ± 10.6 years and 4669 patients (57.79%) had significant coronary artery disease. **Niraj et al.** [19] reported that 720 patients (57.79%) had significant coronary artery disease and the mean age was 60.6 ± 10.5 years. From the results above we found increase in prevalence of CAD with aging.

Regarding diabetes, systemic hypertension and hyperlipidemia as risk factors for CAD in our study, there were 111 patients (55.5%) who had type II diabetes, 100 patients (90%) of them had significant coronary artery disease. There were 127 hypertensive patients, 106 patients (83.464%) of them had significant coronary artery disease. There were 160 patients (80%) with uncontrolled level of LDL, 155 patients (96.88%) of them who had significant coronary artery disease. There were 107 patients (53.5%) with history of smoking, 91 patients (85.05%) of them had significant coronary artery disease. These results are similar to that of **Gregory et al.** [17] where 6782 patients (83.95%) were overweight or obese, 3898 patients (57.48%) of them had significant coronary artery disease and 1917 patients (28.3%) of them had type II diabetes, 4499 patients (66.34%) of them were hypertensive and 5455 patients (80.43%) of them had hyperlipidemia. In **Niraj et al.** [19] study, 618 patients (80.26%) were overweight or obese, 585 patients (81.25%) of them had significant coronary artery disease, 230 patients (37.21%) of them had type II diabetes, 436 patients (70.6%) of them were hypertensive, and 380 patients (61.45%) of them had hyperlipidemia. In **Baghbani-Oskouei et al.** [18] study, there were 185 patients of significant coronary artery disease, 39 patients (21%) of them were diabetic and 156 patients (84%) were hypertensive.

Obesity's relationship with HTN has been well described in the literature in large studies. **Wilson et al.** [20] demonstrated that 34% of HTN in men and 62% of HTN in women aged 35-75 years was attributable to excess weight (defined as a BMI ≥25 kg/m^2). **Gelber et al.** [21] reported 8% increase in risk of incidence of HTN with each 1-unit increase in BMI during a median follow-up of 14.5 years. Weight loss on the other hand, decreases the risk of HTN. An analysis of **Moore et al.** [22] demonstrated that sustained weight loss of 1.8 kg or more was associated with a long-term HTN risk reduction of 22% in middle-aged patients and a 26% reduction in older patients.

CAD is an important preventable health problem as many of its risk factors are modifiable. Modifications of risk factors of CAD are the most important interventions to reduce morbidity and mortality of CAD. CAD risk factors are classified into modified (e.g., diabetes, high blood pressure, smoking, obesity, etc.) and unmodified (e.g., age and genetic factors). Prevalence of CAD increases along with increasing prevalence of its risk factors [23]. Reduction of CAD was tried by primary and secondary prevention strategies; primary prevention as behavioral changes and risk factors modifications [24]. Meanwhile, secondary prevention of CAD is an important objective; it leads to reduction of cardiac events especially acute MI [25].

CONCLUSION

Obesity, diabetes, hypertension, hyperlipidemia, aging and male gender were correlated with severity of CAD. Thus, reduction of weight, stoppage of smoking and control of diabetes, hypertension and hyperlipidemia will improve outcome of coronary artery disease. Due to CAD high expenses of treatment and their complications, appropriate approach, prevention, and treatment lead to save economic resources and health costs. Awareness to CAD risk factors will result in achieving prevention, control, and stability. These achievements lead to lowering of risk factors, treatment expenses, and improving quality of life and eventually minimize illnesses and disabilities.

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