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ORIGINAL RESEARCH

Higher Baseline Serum Irisin Decreases Risk for Body Mass Index Increment in Chinese Populations: A 3.2-Year Cohort Study

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ABSTRACT

Introduction: Irisin, a newly discovered myokine, exerts beneficial effects on energy metabolism. However, published results from studies examining the relationship between irisin concentration and obesity have been conflicting. The aim of our study was to investigate the association between serum irisin level and obese individuals with different body mass index (BMI) values and to explore the question of whether serum irisin can predict the risk of increases in the BMI.

Methods: This study based on the data collected in the Risk Evaluation of cAncers in Chinese diabeTic Individuals: a lONgitudinal (REACTION). The cross-sectional cohort study was carried out from May 2011 to August 2011, and a longitudinal cohort study was conducted from July 2014 to October 2014 to complete the first 3.2-year follow-up. We enrolled 93 low-weight subjects (BMI < 18.5 kg/m^2), 94 normal-weight subjects (BMI 18.5–23.9 kg/m^2), 98 overweight subjects (BMI 24.0–27.9 kg/m^2) and 93 obese subjects (BMI ≥ 28 kg/m^2). Subjects in the normal-weight, overweight and obese groups were selected to match low-weight subjects by age and sex. Serum samples were obtained from all subjects to determine the irisin level.

Results: Subjects with a higher serum irisin level tended to have significantly lower changes in BMI and body fat percentage and higher baseline high-density lipoprotein cholesterol level ($p < 0.05$). No significant correlation was observed between serum irisin level and the baseline obesity index. Serum irisin level was positively correlated to an active lifestyle (i.e. physical activity; $\beta = 1.138$, $p = 0.032$) and negatively correlated to fasting plasma glucose level ($\beta = -0.996$, $p = 0.023$), changes in BMI ($\beta = -0.533$, $p = 0.002$), waist circumference ($\beta = -0.102$, $p = 0.018$), body fat percentage ($\beta = -0.457$, $p = 0.001$) and Chinese visceral adiposity index ($\beta = -0.280$, $p = 0.028$). After adjustment for cofactors, higher baseline serum irisin was an independent factor for a decreased BMI increment (baseline serum irisin: odds ratio 0.747, 95% confidence interval 0.652–0.949, $p = 0.002$).

Conclusions: Higher serum irisin at baseline independently predicted a lower BMI increment in Chinese populations.

Keywords: Body mass index; Irisin; Obesity

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INTRODUCTION

Obesity has become one of the most common non-communicable chronic diseases worldwide, with excessive intake of high-calorie food and decreased physical activity being the primary driving factors [1]. Obese individuals are at increased risk of developing type 2 diabetes mellitus (T2DM), hyperlipidemia, hyperuricemia, respiratory obstruction, gastroesophageal reflux disease and cardiovascular diseases, all of which reduce life quality and aggravate the social burden of the individual. In recent years, skeletal muscle has been recognized as an endocrine organ that secretes hormones with beneficial effects on glucose, lipid and energy metabolism, an action which could explain the effective intervention of physical activities on reversing obesity [2]. Irisin, a newly discovered myokine, is proteolytically cleaved from fibronectin type III domain-containing protein 5 (FNDC5) and released into the blood [3]. Irisin is a signaling molecule which transmits messages between skeletal muscle and other endocrine organs. It has been proposed that irisin induces the expression of the uncoupling protein 1 (UCP1) gene and white adipose tissue browning and increases whole body energy expenditures [3]. In one study, the administration of r-irisin to obese mice fed a high-fat diet improved glucose tolerance and reduced bodyweight [4]. In another study, mCaROCK1 mice had low plasma irisin levels, characterized by obesity and insulin resistance, which were improved after irisin administration [5]. Thus, irisin has been receiving significant interest recently as it has the potential to become a new treatment target for obesity, as well as other metabolic disorders.

However, the results of studies conducted to date that have evaluated the correlation between circulating irisin levels and obesity in humans are controversial. Huh et al. demonstrated that circulating irisin was positively correlated with the body mass index (BMI) and fat-free mass in white healthy adult women and that the irisin concentration decreased with the loss of fat-free mass and decrease in BMI after bariatric surgery in morbidly obese subjects [6]. However, the decrease in circulating irisin disappeared after adjustment with fat-free mass [6]. In another study, Moreno et al. reported that circulating irisin was positively correlated with the BMI, body weight and insulin resistance in Caucasian sedentary subjects without diabetes [7], but in an earlier study Moreno-Navarrete et al. reported that obese Caucasians were characterized by lower FNDC5 gene expression in skeletal muscle and adipose tissue, as well as decreased serum irisin level [8]. Among Chinese adults with abdominal obesity, serum irisin has been found to have no correlation to BMI, body fat and muscle mass [9]. The discrepancies among the results of these clinical studies may be due to differences in the study populations (i.e. ethnicity; different metabolic characteristics) and the relatively small sample sizes. Moreover, most of them were cross-sectional studies that failed to determine whether circulating irisin is related to the development of obesity and other metabolic diseases.

Here we report the results of a 3.2-year longitudinal follow-up study. The aim of this study was to investigate the association between serum irisin and baseline obesity among subjects with different BMI values and to examine whether serum irisin level could be used as a marker to predict the risk of BMI increment.

METHODS

Design and Subjects

The study reported here is based on data collected in the Risk Evaluation of cAncers in Chinese diabeTic Individuals: a lONgitudinal study (REACTION), a cross-sectional cohort study conducted from May 2011 to August 2011 in which 10140 individuals aged $\geq$ 40 years participated. A longitudinal cohort study was conducted from July 2014 to October 2014 to complete the first 3.2-year follow-up. All participants completed a questionnaire survey, underwent a physical examination and had blood drawn. Serum samples were stored at − 80 °C. All procedures performed in the studies involving human participants were in accordance with the human research ethics

committee of the Affiliated Hospital of Guizhou Medical University and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

In the present study, subjects receiving antidiabetic drugs, antihypertensive drugs and anti-hyperlipidemic drugs were excluded to avoid possible confounders. According to the criteria set for the Chinese population [10], we enrolled 93 low-weight subjects (BMI < 18.5 kg/m^2), 94 normal-weight subjects (BMI 18.5–23.9 kg/m^2), 98 overweight subjects (BMI 24.0–27.9 kg/m^2) and 93 obese subjects (BMI ≥ 28 kg/m^2). Subjects in the normal-weight, overweight and obese groups were selected to match the low-weight subjects by age and sex. Finally, serum samples were obtained from these subjects to determine the irisin level.

Data Collection

A standard questionnaire was administered by hospital personnel who received intensive training on epidemiologic screening methods for obtaining information on demographic characteristics, personal and family medical history and lifestyle risk factors [11]. Active physical activity was defined as participation in moderate or vigorous activity for ≥ 30 min per day at least 3 days a week.

Anthropometric Measurements

Anthropometric data, including height, weight, waist circumference (WC), hip circumference and blood pressure (including systolic blood pressure [SBP] and diastolic blood pressure [DBP]), were obtained during the standard physical examination in the REACTION [11]. BMI was calculated as weight (kg) divided by the square of the height (m). Body fat percentage (BF%) was calculated by prediction formula [BF% = 1.20 × BMI + 0.23 × age − 5.4–10.8(if male)] [12].

Biochemical Measurements

All blood samples from participants were obtained after 10 h of fasting. All participants underwent a 75 g oral glucose tolerance test, following which fasting plasma glucose (FPG) and 2-h plasma glucose were determined by the hexokinase method. Total cholesterol and triglyceride (TG) levels were measured by an enzymatic method. High-density lipoprotein cholesterol (HDL-C) was measured by an accelerated selective dissolution method, and low-density lipoprotein cholesterol (LDL-C) was measured by a uniform phase enzymatic method. Chinese visceral adiposity index (CVAI) was estimated separately for males and females as CVAI = − 267.93 + 0.68 × age + 0.03 × BMI + 4.00 × WC + 22.00 × log10TG − 16.32 × HDL-C (males) and CVAI = − 187.32 + 1.71 × age + 4.23 × BMI + 1.12 × WC + 39.76 × log10TG − 11.66 × HDL-C (females) [13]. Serum creatinine was measured on an auto-analyzer. Serum irisin concentration was measured using an enzyme-linked immunosorbent assay (ELISA) kit (#EK-067-29; Phoenix Pharmaceuticals, Inc.). This ELISA assay has a detection range of 0.1 to 1000 ng/ml and is considered to be the best ELISA kit for measuring irisin levels currently available [14]. The intra-assay and inter-assay coefficients of variation were both $< 10\%$.

Statistical Analyses

All statistical data were analyzed using SPSS statistical software version 20.0 (IBM Corp., Armonk, NY, USA). Changes in values in clinical characteristics were calculated as the product of: value at follow-up − value at baseline. The Kolmogorov–Smirnov test was used to evaluate whether the continuous variables were normally distributed. Variables that were not normally distributed were log-transformed before analysis. Data were presented as the mean ± standard deviation ($x \pm s$) for continuous variables with a normal distribution or as percentage frequency. Comparisons between three groups were performed by using analysis of variance. The correlation between serum

irisin and other metabolic parameters was analyzed by univariable linear regression analysis. Binary logistic regression was used to evaluate the odds ratio (OR) of risk factors for BMI increment. Two-sided p values of < 0.05 were considered to be statistically significant.

RESULTS

Subjects were divided into three groups according to the tertiles of baseline serum irisin. Subjects with higher serum irisin levels had a significantly lower change in BMI and BF% and a higher baseline HDL-C ($p < 0.05$ in Table 1). Table 2 shows the association between serum irisin and clinical characteristics. Serum irisin was positively correlated to an active lifestyle with physical activity ($\beta = 1.138$, $p = 0.032$) and negatively correlated to FPG level ($\beta = -0.996$, $p = 0.023$), changes in BMI ($\beta = -0.533$, $p = 0.002$), WC ($\beta = -0.102$, $p = 0.018$), BF% ($\beta = -0.457$, $p = 0.001$) and CVAI ($\beta = -0.280$, $p = 0.028$). No significant correlation was observed between serum irisin and baseline BMI. The OR for BMI increment is shown in Table 3. In the crude analysis, factors associated with BMI increment over the 3.2-year study period were age (OR 1.735, 95% confidence interval [CI] 1.144–1.993, $p = 0.017$), baseline serum irisin level (OR 0.952, 95% CI 903–0.993, $p = 0.021$), baseline BMI (OR 0.954, 95% CI 0.913–0.997, $p = 0.034$), baseline BF% (OR 0.971, 95% CI 0.944–0.998, $p = 0.038$), baseline LDL-C (OR 2.122, 95% CI 1.212–3.176, $p = 0.008$), baseline SBP (OR 0.986, 95% CI 0.974–0.998, $p = 0.024$), baseline DBP (OR 0.981, 95% CI 0.962–0.990, $p = 0.042$), change in WC (OR 1.103, 95% CI 1.099–1.553, $p = 0.010$), change in weight (OR 1.145, 95% CI 1.094–4.864, $p = 0.010$), change in BF% (OR 1.349, 95% CI 1.226–1.845, $p = 0.002$), change in CVAI (OR 1.045, 95% CI 1.036–1.064, $p = 0.032$) and change in HDL-C (OR 0.868, 95% CI 0.391–0.998, $p = 0.013$). After adjustment with various factors (including age and baseline characteristics [BMI, BF%, LDL-C, SBP, DBP]), change in the obesity index (weight, WC, BF% and CVAI) and change in HDL-C), baseline serum irisin level and BMI were independent factors contributing to the decrease of BMI increment (baseline serum irisin: OR 0.747, 95% CI 0.652–0.949, $p = 0.002$; baseline BMI: OR 0.683, 95% CI 0.378–0.854, $p = 0.012$), but larger change in BF% was an independent risk factor associated with BMI increment (OR 1.367, 95% CI:1.233–1.513, $p = 0.022$).

DISCUSSION

The aim of our study was to explore the association between serum irisin and obesity. We found that the baseline serum irisin level was not associated with baseline BMI, WC, BF% and CVAI. To our knowledge, no study has yet examined the association between irisin and change in obesity index without intervention. Therefore, we explored the possible predictive value of baseline serum irisin for change in obesity index in populations with a well-distributed spectrum of BMI values and found that higher serum irisin level at baseline independently predicted a decrease in the BMI over 3.2 years.

To date, results from different studies assessing the association between obesity and irisin are contradictory [6, 7, 15–18]. Choi and colleagues reported that serum irisin level was inversely correlated with BMI in a Korean population consisting of over 20-year-olds [15]. Klangjareonchai et al. found that the serum irisin was negatively associated with the BMI in healthy Thai men [16]. Among Caucasian populations, results from cross-sectional studies indicate a positive association between serum irisin level and parameters of adiposity, such as BMI, weight and fat mass [6, 7, 17, 18], which can be explained by the significant reduction in inrisin concentration with a decease in weight and BMI [6, 17]. The participants in these different studies were in different metabolic states and of different ethnicity, possibly contributing to the inconsistent results. Only a few studies conducted to date enrolled subjects with different BMIs, and the subgroup sample size based on different BMIs were < 50, which is relatively small [19, 20]. Compared with these previous studies, our study had a sample size of nearly 100 subjects per subgroup, and each subject was

Table 1 Clinical characteristics by tertile distribution of serum irisin level

Clinical characteristics	Serum irisin level among participants			*p* value (among the three groups)
	Lower tertile group (*n* = 128)	Middle tertile group (*n* = 125)	Upper tertile group (*n* = 125)	
Range of serum irisin level (ng/ml)	1.101 ~ 11.451	11.459 ~ 15.066	15.098 ~ 37.815	
Age (years)	56.7 ± 8.0	56.5 ± 8.2	56.5 ± 8.6	0.985
Proportion of participants physically active according to definition (%)	32.8%	39.2%	45.6%	0.114
Weight (kg)				
Baseline	58.2 ± 13.1	58.6 ± 12.0	57.2 ± 13.0	0.652
Change value	1.20 ± 3.02	0.60 ± 3.63	− 0.25 ± 5.8	0.304
BMI (kg/m^2)				
Baseline	23.5 ± 4.7	23.7 ± 4.3	23.5 ± 4.9	0.903
Change value	0.22 ± 1.15	0.21 ± 1.37	− 0.24 ± 1.85	0.020*
WC (cm)				
Baseline	83.0 ± 11.8	82.1 ± 11.4	82.9 ± 11.9	0.770
Change value	3.92 ± 5.52	4.13 ± 6.01	2.52 ± 6.46	0.071
FPG (mmol/L)				
Baseline	5.5 ± 0.6	5.7 ± 0.6	5.6 ± 0.7	0.324
Change value	− 0.11 ± 0.62	− 0.21 ± 0.50	− 0.05 ± 0.66	0.103
2hPG (mmol/L)				
Baseline	7.6 ± 2.0	7.4 ± 1.7	7.5 ± 2.2	0.681
Change value	− 0.05 ± 2.09	0.22 ± 1.75	0.38 ± 2.30	0.242
TC (mmol/L)				
Baseline	4.54 ± 1.29	4.53 ± 1.03	4.74 ± 1.22	0.206
Change value	0.85 ± 1.47	0.87 ± 1.32	0.60 ± 1.58	0.268
TG (mmol/L)[a]				
Baseline	1.8 ± 1.64	1.49 ± 0.94	1.79 ± 1.66	0.265
Change value	− 0.06 ± 1.95	0.31 ± 1.50	0.10 ± 2.19	0.312
HDL-C (mmol/L)				
Baseline	1.21 ± 0.37	1.29 ± 0.35	1.32 ± 0.39	0.037*
Change value	0.25 ± 0.52	0.15 ± 0.48	0.14 ± 0.56	0.186
LDL-C (mmol/L)				
Baseline	2.55 ± 0.86	2.60 ± 0.76	2.73 ± 0.85	0.195
Change value	0.61 ± 1.01	0.57 ± 1.02	0.35 ± 1.14	0.108

Table 1 continued

Clinical characteristics	Serum irisin level among participants			*p* value (among the three groups)
	Lower tertile group (*n* = 128)	Middle tertile group (*n* = 125)	Upper tertile group (*n* = 125)	
SBP (mmHg)				
Baseline	117.2 ± 16.2	116.8 ± 19.3	116.4 ± 16.3	0.924
Change value	6.24 ± 23.50	2.55 ± 23.91	8.41 ± 27.6	0.373
DBP (mmHg)				
Baseline	75.3 ± 11.2	74.7 ± 10.7	74.7 ± 10.9	0.878
Change value	3.58 ± 15.00	0.89 ± 15.04	2.83 ± 16.85	0.178
Body fat percentage (%)				
Baseline	32.8 ± 7.0	33.4 ± 7.6	33.2 ± 7.5	0.870
Change value	1.01 ± 1.51	0.94 ± 1.64	0.39 ± 2.22	0.012*
CVAI				
Baseline	92.9 ± 44.7	88.5 ± 43.9	91.5 ± 43.3	0.719
Change value	10.81 ± 19.67	11.17 ± 19.40	7.01 ± 20.68	0.109
Creatinine (mmol/L)				
Baseline	68.0 ± 16.4	67.5 ± 14.9	67.6 ± 14.4	0.970
Change value	10.18 ± 19.59	7.40 ± 17.57	9.51 ± 16.46	0.439

*$p < 0.05$ among the three groups

Data are presented as the mean ± standard deviation (SD), unless indicated otherwise

BMI Body mass index, *WC* waist circumference, *SBP* systolic blood pressure, *DBP* diastolic blood pressure, *FPG* fasting plasma glucose, *2hPG* 2 h plasma glucose, *TC* total cholesterol, *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol, *LDL-C* low-density lipoprotein cholesterol, *CVAI* Chinese visceral adiposity index

[a] Data were log transformed before analysis

matched by sex and age. However, we failed to find that circulating irisin was associated with the baseline BMI, weight and BF%; these results are consistent with those from a number of other Chinese clinical studies [9, 21]. Taking into account past results together with our results, no consistent association has been found between serum irisin level and the baseline obesity index. Larger cross-sectional and prospective studies in different populations are needed for further investigation.

Interestingly, we found that baseline serum irisin level was negatively associated with changes in BMI, WC, BF% and CVAI and that a higher baseline serum irisin level was associated with lesser BMI increment in a cohort followed for 3.2 years. Similar results were found among Spanish obese adults, with the authors of that study reporting that higher baseline irisin was associated with a greater reduction in body weight [22]. There have been studies examining the relationship between irisin concentration and dynamic changes in the obesity index due to diet, exercise or surgery intervention [16, 22, 23]. To our knowledge, our study is the first study to examine the association between irisin concentration and BMI variation without intervention in a longitudinal study.

Irisin is a myokine that has been found to be effective in inducing browning in white adipose

Table 2 Univariable linear regression of serum irisin with clinical characteristics

Clinical characteristics	*β*	*P* value
Age (years)	0.002	0.937
Active physical activity score (1 = negative, 2 = positive)	1.138	0.032*
Baseline		
Weight (kg)	− 0.019	0.353
BMI (kg/m^2)	0.002	0.973
WC (cm)	− 0.006	0.778
Body fat percentage (%)	0.031	0.375
CVAI	− 0.002	0.796
FPG (mmo/L)	− 0.996	0.023*
2hPG (mmo/L)	− 0.123	0.347
TC (mmo/L)	0.078	0.720
TG (mmo/L)[a]	− 0.187	0.292
HDL-C (mmo/L)	0.894	0.199
LDL-C (mmo/L)	0.312	0.321
SBP (mmHg)	− 0.002	0.872
DBP (mmHg)	− 0.007	0.766
Creatinine (mmo/L)	− 0.019	0.264
Change		
Weight (kg)	− 0.081	0.179
BMI (kg/m^2)	− 0.533	0.002*
WC (cm)	− 0.102	0.018*
Body fat percentage (%)	− 0.457	0.001**
CVAI	− 0.280	0.028*
FPG (mmo/L)	0.126	0.062
2hPG (mmo/L)	0.178	0.058
TC (mmo/L)	− 0.120	0.680
TG (mmo/L)[a]	0.105	0.770
LDL-C (mmo/L)	− 0.344	0.159
HDL-C (mmo/L)	− 0.297	0.549
SBP (mmHg)	− 0.005	0.620
DBP (mmHg)	− 0.004	0.833
Creatinine (mmo/L)	0.004	0.803

*$p < 0.05$, **$p < 0.01$

[a] Data were log transformed before analysis

tissue [3]. Adipose tissue browning is accompanied by a higher oxygen consumption, higher energy expenditure and weight loss [3]. In an in vivo study, r-irisin administered to diet-induced obese mice brought about an improvement in body weight and glucose metabolism; in vitro, when r-irisin was added to mouse primary adipocytes, expression of thermogenic genes, such as *UCP-1*, *PGC-1α* and *Cox7α*, and energy consumption were increased [4]. Therefore, it may be postulated that a higher baseline irisin level may prevent an increase in the BMI by inducing more energy expenditure.

Consistent with previous findings [8, 9, 15], our study demonstrated that serum irisin was negatively correlated to the FPG level. Irisin is a C-terminal proteolytical product of FNDC5, encoded by *FNDC5*, which can be induced in skeletal muscle by PGC1α (peroxisome proliferator-activated receptor gamma coactivator 1-alpha) by exercise [3]. In our study, serum irisin level was also positively correlated with active physical activity. PGC1α expression was found to be downregulated and the activity of PGC1α to be decreased in the skeletal muscles of patients with T2DM or insulin resistance [24]. In these patients, even increasing exercise cannot stimulate PGC1α expression in skeletal muscles, a condition known as "exercise resistance" [25]. In humans, FNDC5 is mainly expressed in skeletal muscles, followed by lower expression in adipose tissue [6]. Studies have shown that FNDC5 expression in adipose tissue and skeletal muscle was reduced in obese and T2DM patients [8, 26]. It would appear, therefore, that prediabetic or diabetic people have lower serum irisin levels.

There are a number of limitations to our study. First, the sample size of each subgroup was relatively small, and in the longitudinal study, the number of cases was limited to be

Table 3 Odds ratios and 95% confidence intervals of risk factors for body mass index increment

Clinical characteristics	Crude OR (95% CI)	*p* value	Adjusted OR (95% CI)[a]	*p* value
Age	1.735 (1.144–1.993)	0.017*		
Active physical activity (negative vs. positive)	0.758 (0.398–1.941)	0.070		
Baseline				0.002**
Serum irisin (ng/ml)	0.952 (0.903–0.993)	0.021*	0.747 (0.652–0.949)	
Weight (kg)	0.986 (0.970–1.002)	0.079		
BMI (kg/m^2)	0.954 (0.913–0.997)	0.034*	0.683 (0.378–0.854)	0.012**
WC (cm)	0.963 (0.734–1.783)	0.336		
Body fat percentage (%)	0.971 (0.944–0.998)	0.038*		
CVAI	0.989 (0.726–1.998)	0.144		
FPG (mmol/L)	0.815 (0.576–1.153)	0.248		
2hPG (mmol/L)	0.900 (0.810–1.000)	0.050		
TC (mmol/L)	1.146 (0.965–1.360)	0.120		
TG (mmol/L)[b]	0.935 (0.809–1.080)	0.361		
HDL-C (mmol/L)	1.220 (0.953–1.562)	0.114		
LDL-C (mmol/L)	2.122 (1.212–3.716)	0.008**		
SBP (mmHg)	0.986 (0.974–0.998)	0.024*		
DBP (mmHg)	0.981 (0.962–0.990)	0.042*		
Change				
Weight (kg)	1.145 (1.094–4.864)	0.010**		
WC (cm)	1.103 (1.099–1.553)	0.010*		
Body fat percentage (%)	1.349 (1.226–1.845)	0.002**	1.367 (1.233–1.513)	0.022**
CVAI	1.045 (1.036–1.064)	0.032*		
FPG (mmol/L)	0.892 (0.613–1.211)	0.892		
2hPG (mmol/L)	0.894 (0.990–1.208)	0.894		
TC (mmol/L)	0.913 (0.866–1.142)	0.435		
TG (mmol/L)[b]	0.901 (0.963–1.202)	0.901		
HDL-C (mmol/L)	0.868 (0.391–0.998)	0.013*		
LDL-C (mmol/L)	0.893 (0.857–1.254)	0.320		
SBP (mmHg)	0.874 (1.005–1.022)	0.124		

Table 3 continued

Clinical characteristics	Crude OR (95% CI)	*p* value	Adjusted OR (95% CI)[a]	*p* value
DBP (mmHg)	0.867 (0.709–1.037)	0.178		

OR Odds ratio, CI confidence interval

$^{*}p < 0.05$, $^{**}p < 0.01$

[a] ORs were adjusted by age, serum irisin, baseline characteristics (BMI, body fat percentage, LDL-C, SBP, DBP), change in obesity index (weight, WC, body fat percentage and CVAI) and change in HDL-C

[b] Log transformation before analysis

able to examine the possible predictive role of serum irisin for developing obesity, which was why BMI increment was chosen as primary outcome. Second, although BMI is the most common index defining obesity and overweight, it is a relatively rough measurement and cannot be used to evaluate the degree of obesity with precision. Third, the serum samples used in our present study were collected in 2011. These samples were stored − 80 °C without repeated freezing and thawing for nearly 6 years. To test for degradation, we enrolled ten newly diagnosed T2DM patients hospitalized at the Endocrinology Department of the Affiliated Hospital of Guizhou Medical University in the study and collected fasting blood samples to determine the serum irisin concentration. In our study, ten subjects in the cross-sectional cohort were selected; these subjects were matched to each patient by age and sex to examine whether the irisin molecule was degraded during storage. No significant difference was found between the serum of these two groups.

In conclusion, the innovation of our study is the exploration of the association between serum irisin levels and BMI in a cross-sectional study of Chinese subjects with different BMIs. Our study is also the first longitudinal study in a Chinese population to examine whether serum irisin can predict a change in BMI. We found that baseline serum irisin level had no association with the baseline BMI, but it did play a predictive role in BMI increment. In the future, prospective studies with a larger sample of Chinese subjects are needed to confirm these observations.

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Disclosures. Ruoyi Liu, Lixin Shi, Nianchun Peng; Qiao Zhang and Hong Li have nothing to disclose.

Compliance with Ethics Guidelines. All procedures performed in studies involving human participants were in accordance with the human research ethics committee of the Affiliated Hospital of Guizhou Medical University and with the 1964 Helsinki declaration and its later amendments or comparable ethical

standards. Informed consent was obtained from all individual participants included in the study.

Data Availability. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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