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Serum Ferritin Level and its Relation with Glycemic Status in People with Prediabetes

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Abstract **Original Research Article**

Background: Changes in serum ferritin levels are associated with glucose intolerance. ***Objectives:*** The objective of the study was to see serum ferritin and HbA1c level in newly detected prediabetes participants. ***Materials and Methods:*** This cross-sectional study included 200 participants categorized by American Diabetes Association diagnostic criteria, 2016. Prediabetes was further categorized as impaired fasting glucose, impaired glucose tolerance, and IFG+IGT. Serum ferritin level was measured by using N Latex ferritin while HbA1c level by high-performance liquid chromatography. ***Results:*** Prediabetes participants had significantly higher age (35.4±1.03 vs. 30.3±0.9 years, mean± SEM; p<0.001); waist circumference (94.1±11.5 vs. 89.5±11.1 cm, mean± SD; p=0.004); systolic & diastolic blood pressure (122±11 vs. 118±11, p=0.013 & 79±6 vs. 75±8 mm of Hg, mean± SD; p<0.001, respectively); with more family history of diabetes and hypertension than normal glucose tolerance (61% vs. 45%, p<0.001, 14% vs. 5%, p<0.001, respectively). Mean serum ferritin level was found to increase in the subgroups with the prediabetes (NGT: 76.8±6.6; IFG: 105.3±16.0; IGT: 145.1±13.5 and IFG+IGT: 130.1±12.4 ng/ml; respectively, p<0.001). HbA1c level showed an increasing trend with subclasses of increasing intensification of dysglycemia: 5.0±0.1; IFG: 5.5±0.1; IGT:5.7±0.1; IFG+IGT: 5.8±0.1 percentage; p<0.001). Within each subgroup of prediabetes serum ferritin level was found comparably higher in the participants having HbA1c>6% [HbA1c<5.7 vs. ≥5.7-6 vs.>6 -for IFG+IGT (116.2±12.4 vs. 117.6±23.6 vs. 150.0±25.1 ng/ml, p=0.419)]. Males had higher serum ferritin level than females- for NGT (139.4±17.3 vs. 53.7±3.9 ng/ml, p<0.0011), IFG (138.0 vs. 94.3±16.6 ng/ml, p=0.319), IGT (208.6±19 vs. 129.6±15 ng/ml, p=0.019) and IFG+IGT (166.3± 27.4 vs. 108.3± 9.2 ng/ml, p=0.021). Serum ferritin level was higher in participants with advancing age also higher in the hypertensive group than that in normotensive -for IFG+IGT (156.6±39.59 vs.123.4±12.1 ng/ml, p=0.290). Serum ferritin level was significantly higher in participants with prediabetes than that of NGT in all BMI groups- for obese (116.8±14.1 vs. 65.4±7.6 ng/ml, p=0.002), for overweight (139.8±9.8 vs. 76.7±10.9 ng/ml, p<0.001) and for normal weight (179.7±37.6 vs. 89.8±15.1 ng/ml, p=0.011). FPG and 2-h PG both significantly correlated with serum ferritin level (r=0.173, p=0.014 and r=0.330, p<0.001, respectively) in all participants. HbA1c also correlated with ferritin in all participants (r=0.289, p<0.001). Multiple regression analysis showed serum ferritin level strongly positively associated with 2-h PG (p=0.013) and weakly with HbA1c (p=0.065). ***Conclusions:*** It is observed that serum ferritin level is higher in participants with prediabetes with increments of HbA1c (%).

Keywords: Ferritin, prediabetes, normal glucose tolerance, HbA1c.

INTRODUCTION

Diabetes mellitus (DM) is a multiple etiologies of metabolic disorder. Ferritin which is an index of body iron stores is an iron-phosphorus-protein complex. There exist influences between iron metabolism and Type 2 diabetes mellitus (T2DM), which scientific evidence has revealed. The relationship

is like: iron affects glucose metabolism and glucose metabolism interrupts on several iron metabolic pathway [1].As a result, the association of high serum ferritin level and hyperglycemia in T2DM has become a topic of interest in recent years. Hyperferritinemia and iron overload may be the primary cause of insulin resistance before overt diabetes mellitus develops [2] and it is a marker of insulin resistance syndrome [3]. Higher serum ferritin is associated with a higher risk of prediabetes in the general population [4]. Serum ferritin level is higher in people with abnormal glucose tolerance (AGT) especially if obese as well as in hypertension [5]. Elevated serum ferritin in prediabetes causes increased mortality [6]. The pathophysiologic mechanism of increased serum ferritin in patients with T2DM remains unclear. Excess iron could theoretically be related to disturbed glucose homeostasis by affecting insulin synthesis and secretion in the pancreas and enhancing lipid oxidation of free fatty acids (FFA) as increased FFA oxidation diminishes glucose utilization in muscle tissue and increases gluconeogenesis in the liver, leading to increased insulin resistance [7]. In addition, accumulating iron could interfere with the insulin extracting capacity of the liver. Elevated ferritin concentrations in diabetes may represent elevated body iron stores, an acute phase reactant, and a marker for inflammation [8].Elevated iron stores may induce prediabetes and diabetes through a variety of mechanisms including oxidative damage to pancreatic β cells, impairment of hepatic glucose extraction by the liver, and interference with insulin's ability to suppress hepatic glucose production [9]. In the absence of a reciprocal decrease of soluble transferrin receptors in comparison with normal controls, many studies revealed increased serum ferritin concentration in T2DM patients. It was found that iron depletion improves vascular dysfunction in T2DM patients with high ferritin concentration [10]. The present study was aimed to see the serum ferritin level in newly detected prediabetes individuals in Bangladesh.

MATERIALS AND METHODS

This cross-sectional study comprising of 200 newly detected prediabetes and normal glucose tolerance individuals categorized by American Diabetes Association (ADA) 2017 criteria. This study had been executed in the Department of Endocrinology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. The ethical approval had been taken from Institutional Review Board (IRB), BSMMU. From each participant, written consent was taken. Patients having disorders like anemia, liver & kidney disease, haemochromatosis, chronic infection, or inflammation that might interfere with ferritin metabolism were discarded. From each participant 5 ml of blood was collected; serum was separated by centrifugation and preserved under -30ºC until assay.

Statistical Analysis

Data were analyzed using computer-based SPSS program version 22.0. All data were expressed as frequencies and mean (±SD/SEM) as applicable. The student's unpaired t-test was used to compare the quantitative characteristics, whereas Chi-square test was used to compare the qualitative characteristics between prediabetes and controls. Comparison of serum ferritin and HbA1c between or among subgroups were done by Student's unpaired t-test or one-way ANOVA test as applicable. Pearson's correlation test was used to see the correlation between serum ferritin and other variables. Multiple regression analysis was done to detect independent variables that influenced serum ferritin level. p -Values $\leq$ 0.05 was considered significant.

RESULTS

Table-1: The Demographics and others clinical characteristics of the Participants.

Parameters	Total	Prediabetes	NGT	p-Value
Participants in number	200	100	100	
Age (mean ±SEM)	32.9±0.9	35.4±1.0	30.3±0.9	<0.001
Sex				
Male	54(27%)	27(27%)	27(27%)	1.00
Female	146(73%)	73(73%)	73(73%)	
Current Smoker	12(6%)	8 (8%)	4(4%)	0.154
Family history of DM	106(53%)	61(61%)	45(45%)	<0.001
BMI(kg/m^2) (mean ±SD)	26.4±4.6	27.1±4.5	25.8±4.7	0.065
Systolic BP (mm of Hg, mean ±SD)	120±12	122±11	118±11	0.013
Diastolic BP (mm of Hg, mean ±SD)	77±7	79±6	75±8	0.001
FPG (mmol/L) (mean ±SD)	5.1±0.6	5.4±0.6	4.8±0.4	0.001
2-h PG after 75-g OGTT (mmol/L, mean ±SD)	7.6±1.5	8.9±1.0	6.3±0.7	0.001
HbA1c (%) (mean ±SD)	5.4±0.5	5.8±0.4	5.0±0.2	0.001
Hb (gm/dl) (mean ±SD)	13.02± 0.07	12.92±0.99	13.14±0.09	0.099

Prediabetes: IFG=Impaired fasting glucose, IGT= Impaired glucose tolerance and IFG+ IGT; NGT= Normal Glucose Tolerance; DM= Diabetes Mellitus; By Student's t- test and Chi Square test, Statistical significance stands for Prediabetes vs. NGT, Within parenthesis are percentiles over column total.

Table 1 shown that, mean serum ferritin level is significantly higher in prediabetes than NGT (137.5±15.5 vs.76.8±6.6 ng/ml, mean ±SEM; p<0.001) (Figure 1). Participants in the group of prediabetes had significantly higher age than NGT (35.4±1.0 vs.30.3±0.9 years, mean ±SEM; p<0.001). Male and female were equally distributed between two groups. Most of them were housewives in two groups. Family history of diabetes and hypertension were found significantly more frequent in prediabetes than NGT (61% vs. 45%, p<0.001; 14% vs. 5%, p<0.001, respectively).

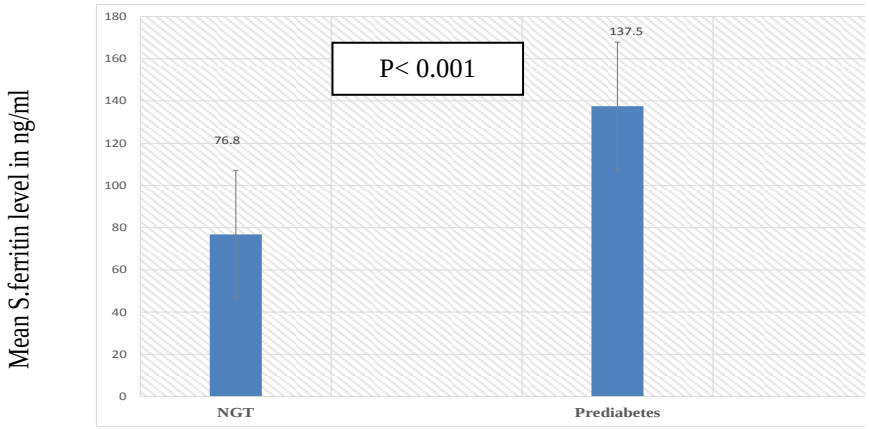

Fig- 1: Serum ferritin level in prediabetes (n=100) and NGT (n=100) participants.

Table-2: Serum ferritin level in participants with IFG, IGT, IFG+IGT and NGT groups.

Participants Group	Serum ferritin level		
	Mean (±SEM)	Median	Range
NGT (n=100)	76.8±6.6	61	10 - 421
IFG (n=4)	105.3±16.0	110.5	62 – 138
IGT (n=56)	145.1± 13.6	120	49 – 643
IFG+IGT (n=40)	130.1±12.4	110	56 - 399
p-Value	<0.001		

By one- way ANOVA test.

Post hoc test:

NGT vs. IFG: p=0.451;	NGT vs. IGT: p<0.001;
NGT vs. IFG+IGT: p=0.002	IFG vs. IGT: p=0.296;
IFG vs. IFG+IGT: p=0.631	IGT vs. IFG+IGT: p=0.799.

Table 2 shown that, both the mean and median values of ferritin were found to be increased in the subgroups with prediabetes (NGT: 76.8±6.6 and 61; IFG: 105.3±16.0 and 110.5; IGT: 145.1±13.6 and 120; IFG+IGT: 130.1±12.4 and 110 ng/ml, respectively). Level of ferritin among the groups was statistically significant (p<0.001)

Table-3: HbA1c (%) level in participants with IFG, IGT, IFG+IGT and NGT.

Group of study participants	HbA1c (%)	
	(Mean ±SEM)	Median
NGT (n=100)	5.0±0.1	5.0
IFG (n=4)	5.5±0.1	5.5
IGT (n=56)	5.7±0.1	5.7
IFG+IGT (n=40)	5.8±0.1	5.8
p-Value	<0.001	

By one- way ANOVA test

Table 3 shown that HbA1c increasing trend with subclasses of increasing intensification of dysglycaemia and statistically significant (NGT: 5.0±0.1 and 5.0; IFG: 5.5±0.1 and 5.5; IGT: 5.7±0.1 and 5.7; IFG+IGT: 5.8±0.1 and 5.8 percentage, respectively, p<0.001).

Table 4: Serum ferritin level (ng/ml) in HbA1c subclasses of participants with IFG, IGT, IFG+IGT and NGT.

Group of study participants	Serum ferritin level (ng/ml) (Mean ±SEM)			
	HbA1c<5.7%	HbA1c=5.7-6%	HbA1c>6%	p-Value
NGT (n=100)	76.8± 6.6			
IFG (n=4)	105.7± 22.7	104.0		0.974
IGT (n=56)	152.2± 22.0	150.6±26.0	133.1±21.6	0.809
IFG+IGT (n=40)	116.2±12.4	117.6±23.6	150±25.1	0.419
Total (N=200)	94.6±6.7	133.5±23.7	140.6±23.2	0.017

By one- way ANOVA test and Student's t-test as applicable

Table 4 displayed that serum ferritin level of different subclasses of glycemic status under HbA1c cutoffs. Within each subgroup of IFG+IGT, serum ferritin level (Mean ±SEM) was found comparably higher, though not statistically significant, in the participants having HbA1c >6% [HbA1c (%) < 5.7 vs. ≥ 5.7-6 vs.>6 -for IFG+IGT; 116.2±12.4 vs. 117.6±23.6 vs. 150.0±25.1 ng/ml, p =0.419]. In IFG and IGT group no significant difference was observed among the sub-groups, rather within each subgroup of IGT level was found comparably lower in the participants having HbA1c >6% (HbA1c < 5.7 vs. ≥ 5.7-6 vs.>6 -for IGT; 152.2±22.0 vs. 150.6±26.0 vs. 133.1±21.6 ng/ml, p =0.809).

Table-5: Serum ferritin level (ng/ml) in males and females in different classes of glycemic status.

Group of study participants	Serum ferritin level (Mean ±SEM)		
	Males	Females	p-Value
NGT(n=100)	139.4±17.3	53.7± 3.9	<0.001
IFG(n=4)	138.0	94.3±16.6	0.319
IGT(n=56)	208.6±19	129.6±15	0.019
IFG+IGT(n=40)	166.3±27.4	108.3±9.2	0.021
Total (n=200)	160.9±20.1	87.2±8.5	0.002

By Student's t-test

Table 5 stated that, comparison of serum ferritin level between male and female within each subclass showed that in most of the subclasses males had higher ferritin level than females which were statistically significant for NGT (139.4±17.3 vs. 53.7± 3.9 ng/ml, p<0.001); IGT (208.6±19.0 vs 129.6±15.0 ng/ml, p=0.019); IFG-IGT (166.3±27.4 vs. 108.3±9.2 ng/ml, p= 0.021) as well as when all participants considered together (160.9±20.1 vs. 87.2±8.5 ng/ml, p=0.002)

Table 6: Serum ferritin level (ng/ml) in different BMI group.

BMI group of study participants	Serum ferritin level (ng/ml) (Mean ±SEM)		
	Prediabetes	NGT	p-value
Normal (n=48)	179.7±37.6	89.8±15.1	0.011
Overweight (n=79)	139.8±9.8	76.7± 10.9	<0.001
Obese (n=73)	116.8±14.1	65.4±7.6	0.002

By Student's t- test

Table 6 demonstrated that, serum ferritin level is significantly higher in all BMI categories participants with prediabetes than that of NGT-for obese (116.8±14.1 vs. 65.4±7.6 ng/ml, p=0.002), for normal weight (179.7±37.6 vs. 89.8±15.1 ng/ml, p=0.011) and overweight (139.8±9.8 vs. 76.7±10.9 ng/ml, p<0.001)

Table-7: Serum ferritin level (ng/ml) in subjects with or without family history of DM.

Group of study participants	Serum ferritin level (ng/ml) (Mean ±SEM)		
	Total subjects	Prediabetes	NGT
Family history of DM (n=106,61,45)	110±8.4	135±12.0	77.3±8.7
No Family history of DM (n=94,39,55)	103.2±8.6	141±13.0	76.4±9.8
p-value	0.537	0.759	0.946

By Student's t-test

Table 7 shown that, serum ferritin level was higher in participants with family history of DM than that of without family history of DM (110±8.4 vs. 103.2±8.6 ng/ml, p=0.537). In the prediabetes group,

mean value was lesser in participants with family history of DM compared to participants without family history of DM (135±12.0 vs. 141±13.0 ng/ml, p=0.759); on the other hand, though not significant, it was higher in participants with family history of DM than that in participants without family history of DM in NGT group (77.3±8.7vs. 76.4±9.8 ng/ml, p=0.946).

Table-8: Serum ferritin level (ng/ml) in hypertensive and normotensive participants.

Group of study participants	Serum ferritin level (ng/ml) (Mean ±SEM)		p-Value
	Normotensive	Hypertensive	
NGT (n=100)	78.8±6.1	39.8± 8.0	0.201
IFG (n=4)	105.3±16.0		
IGT (n=56)	148.4±14.1	133.8±20.0	0.776
IFG+IGT (n=40)	123.4±12.1	156.6±39.5	0.290
Total (N=200)	106.5±9.6	118.7±25.1	0.007

By Student's t- test

Table 8 stated that, serum ferritin level was found to be significantly higher in the hypertensive groups than that of normotensive when all the participants were considered together (118.7±25.1 vs. 106.5±9.6ng/ml, p=0.007). When considered within each subclass it was higher but not significant for IFG-IGT (156.6± 39.5 vs. 123.4± 12.1ng/ml, p=0.290), while decrease in hypertensive group in sub-classes of NGT and IGT (39.8±8.0 vs. 78.8±6.1 ng/ml, p=0.201; and133.8±20.0 vs.148.4± 14.1 ng/ml, p=0.776, respectively).

Table-9: Serum ferritin level (ng/ml) in different age groups.

Age groups (Age in Years)	Serum ferritin level (Mean ±SEM)	p- Value
<25 (n=46)	95.7±9.2	0.728
25-34 (n=78)	107.3±11.3	
35-44 (n=39)	115.7±15.4	
45-54 (n=31)	117.3±11.3	
≥55 (n=6)	85.7±20	

By one- way ANOVA test

Table 9 shown that, the mean (±SEM) of serum ferritin level in different age groups which is higher in advancing age groups but not statistically significant, p=0.728.

Table-10: Correlations between different variables.

Determinants	All participants		Prediabetes		NGT	
	r	p	r	p	r	p
Age vs. HbA1c	0.441	<0.001	0.461	<0.001	0.271	0.006
Age vs. Ferritin	0.006	0.353	0.011	0.915	0.084	0.409
BMI vs. Ferritin	0.031	0.066	0.069	0.496	0.108	0.286
FPG vs. Ferritin	0.173	0.014	0.112	0.266	0.072	0.479
2h-PG vs. Ferritin	0.330	<0.001	0.121	0.232	0.060	0.556
HbA1c vs. Ferritin	0.289	<0.001	0.035	0.728	0.076	0.450
SBP vs. Ferritin	0.026	0.718	0.170	0.091	0.006	0.949
DBP vs. Ferritin	0.100	0.159	0.037	0.708	0.049	0.632

By Pearson's correlation coefficient test

Table 10 shown that, age of the participants significantly correlated with HbA1c for all participants (r=0.441, p<0.001); for prediabetes (r=0.461, p<0.001) and for NGT (r=0.271, p=0.006), but did not correlate with serum ferritin level in any of the groups. BMI also did not correlate with serum ferritin level in any of the groups. FPG significantly correlated with serum ferritin level in all participants (r=0.173, p=0.014) but not in prediabetes (r=0.112, p=0.266) and in NGT (r=0.072, p=0.479). 2-h PG also correlated with serum ferritin level in all participants (r=0.330, p<0.001) but not in prediabetes (r=0.121, p=0.232) and in NGT (r=0.060, p=0.556). HbA1c correlated with serum ferritin level in all participants (r=0.289, p<0.001) but not significantly in prediabetes (r=0.035, p=0.728) and NGT (r=0.076, p=0.450). Both systolic and diastolic BP not significantly correlated with serum ferritin level in prediabetes (r=0.170, p=0.091 and r=0.006, p=0.949 respectively) and in NGT (r=0.037, p=0.708 and r=0.049, p=0.632 respectively).

Table-10: Regression analysis of variables that influenced serum ferritin level (ng/ml) in newly detected prediabetes subjects.

Independent variables	β	S.E.	p-Value
Constant	-101.83	106.89	0.342
Age	-0.487	0.690	0.481
BMI	-1.320	3.200	0.680
Waist circumference	-0.062	1.290	0.962
FPG	-3.420	12.010	0.776
2-h PG	12.940	5.170	0.013
HbA1c	33.240	17.930	0.065
HTN	5.460	22.060	0.805
F/H of DM	-3.530	12.180	0.772

Table 11 stated, multiple regression analysis to determine the association of serum ferritin level with different variables. In this model serum ferritin level was taken as dependent variable while age, BMI, waist circumference, FPG, 2-h PG, HbA1c, HTN and F/H of DM were independent variables. Serum ferritin level strongly positively associated with 2-h PG (p=0.013), whereas weakly associated with HbA1c (p=0.065). Other variables [age (p=0.481), BMI (p=0.680), Waist circumference (p=0.962), FPG (p=0.776), HTN (p=0.805) and F/H of DM (p=0.772)] were not associated with serum ferritin level.

DISCUSSION

In the present study serum, ferritin level was found significantly increased in prediabetes participants than that in NGT. This finding was associated with a study [11]. In the present study, it was observed that serum ferritin level increased with the deterioration of glycemic status in the prediabetes participants. Some other investigators were abroad also similar with these observations findings [11, 12].Serum ferritin level with HbA1c were positively correlated with all participant and which was found significantly higher in participants with higher HbA1c which was similar to the findings of some investigators in our country and in abroad [5, 9, 13]. Highest level of serum ferritin was observed in IGT and IFG+IGT subgroups of prediabetes. IFG+IGT subgroup had serum ferritin level below that of IGT but above the level of serum ferritin found in the IFG and NGT groups, similar findings were found by [14]. It is also reflected by regression analysis that showed 2-h PG had a significant positive influence on serum ferritin level. Thus, it appears that the intensity of glucose intolerance may be proportionately related to the increased level of serum ferritin. This is also reflected by the findings that in the all participants group, FPG, and 2-h PG positively correlated with serum ferritin level (which may be applicable for the IGT and IFG+IGT groups of prediabetes for higher ferritin level). It was also observed that HbA1c showed an increasing trend with subclasses of increasing intensification of dysglycaemia. This is to be explained on the basis that the magnitude of glycemic intolerance varies from person to person. These findings are supported by the findings of other investigators who observed serum ferritin level to be higher in the prediabetes and diabetic participants with increasing intensification of dysglycaemia [5, 11, 12]. Apropos with this, it is to be mentioned that higher serum ferritin level is associated with insulin resistance which is one of the important factors for the development of AGT [15, 16]. Also serum ferritin level was found to be higher with prediabetes irrespective of body mass index as was found by[17]. Serum ferritin level was higher in males than females irrespective of glycemic status which was similar to the findings of some investigators [5,13,18,19] This is the general finding of increased serum ferritin levels in males than females. The presence of co-morbidity like hypertension was associated with higher serum ferritin level in the IFG+IGT subclass of prediabetes, which is also observed by other investigators [7, 11] and in participants with a family history of diabetes frequency of prediabetes was observed to be higher but no significant difference between the level of serum ferritin of two groups (with or without a family history of DM). It was found that serum ferritin concentration was higher in the IFG+IGT group of prediabetes participants with HbA1c>6% than that with HbA1c <5.7% and HbA1c=5.7-6%. Therefore, it is pertinent to assume that the increased level of serum ferritin is associated with a higher HbA1c level which is an indicator for the assessment of over dysglycemia. In agreement with this, some others observers abroad [9, 13] and nationally [5] found similar findings of serum ferritin concentration that was higher in participants with increased HbA1c. The age of the participants with prediabetes was higher than that of NGT and there was a positive relationship of age with HbA1c in all groups as prediabetes, NGT, and all participants considered together. However, age did not show any significant correlation with serum ferritin level either in prediabetes or in NGT individually or when all participants considered together. However, overall age-related increase serum ferritin level was shown in different age groups, and increased age might be one of the main factors for the abnormal glucose tolerance in the prediabetes group, but age did not significantly correlate with serum ferritin level either in prediabetes or in NGT groups. Therefore, increased age may be some factor for

glucose abnormality but unlikely to be the causal factor for increased serum ferritin level observed in the different age groups. This study observed males had higher serum ferritin concentration than females for all subclasses of glycemic status, which was similar to the findings of some investigators [5, 7, 13, 17, 18]. Distribution of male and female participants happened to be statistically similar in prediabetes and NGT groups. Therefore, the higher serum ferritin level in prediabetes and its subclasses is unlikely to be attributable to the present finding of higher serum ferritin levels in males. It is wise to think that higher serum ferritin levels in prediabetes and that male are separate entities. Moreover, for the present study, serum ferritin level in males is not a priority subject. The frequency of positive family history of DM was significantly higher in prediabetes than in NGT. Serum ferritin level was found not to be higher in prediabetes participants with a family history of DM. The findings of higher serum ferritin levels in participants without a family history of DM in the prediabetes group cannot be explained. Thus it will be wise to think that family history of DM is a predisposing factor for dysglycemia whereas its association with serum ferritin level yet to be established. Both BMI and waist circumference were higher in prediabetes participants. Serum ferritin level was found to be higher in prediabetes irrespective of BMI status (in all groups of normal weight, overweight and obese participants) than those values in the NGT group and the difference reached a statistically significant level. Some others [5, 7, 17, 19] have noted similar findings. Therefore, it appears that an increased level of serum ferritin is associated with abnormal glycemic status rather than increased BMI. Serum ferritin level was also observed to be higher in the hypertensive participants in the IFG+IGT sub-group of prediabetes, but lower in the hypertensive NGT group; however, the level of significance was poor in different sub-groups of prediabetes. In agreement with this, some others have reported higher serum ferritin levels in hypertensive AGT participants [7, 11]. On the other hand, both systolic and diastolic blood pressure were significantly higher in the prediabetes group than that of NGT, though within normal limit and its explanation is that blood pressure increases in prediabetes participants. Hypertensive patients were also higher in the prediabetes group. As a matter of fact, both systolic and diastolic blood pressure not correlated with serum ferritin level in the prediabetes group; also there was no such significant correlation of these two variables in the NGT group. Therefore, it seems vindicated to constellate that hypertension may be associated with the increment of ferritin in subjects with dysglycemia. Overall, it is followed that dysglycemia which might be predisposed by a family history of DM is a central concern for prediabetes, overweight-obesity, hypertension-a condition considered as metabolic syndrome. In conclusion, the present study estimated serum ferritin level in participants with newly detected prediabetes was found to be higher. It is observed that serum ferritin level is higher in participants with hypertensive prediabetes, whereas higher ferritin values with increasing age seem to be an outcome product of these factors which act as direct risk components for the development of AGT. The findings of the present study need validation by the investigation at a wide scale.

CONCLUSION

Serum ferritin level in participants with newly detected prediabetes was found to be higher in this study. Among the participants with prediabetes higher serum ferritin level was observed with increments of HbA1c (%) as well as with hypertension, male participants and increasing age.

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