Conjugated and free fucose in patients with vitamin D deficiency in Samarra city

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Abstract

The study was conducted to sixty-one serum samples, thirty-five of them with Vitamin D deficiency-VDD (act as patient group-Pg), and twenty-six as a control group (Cg). The study include measurement of Vitamin D,free fucose, protein binding fucose and lipid binding fucose concentration in sera of patients and control group. Results showed that the concentration of free fucose, protein binding fucose and lipid binding fucose were significantly increased (at probability value ≤0.05) in sera of patients with VDD as compared with Cg. So from the results of the study, we can conclude that the elevation of free fucose, protein binding fucose, and lipid binding fucose with a low of Vit-D level may be a risk factor for many critical diseases such as bone diseases, cancer and cardiovascular diseases.

Keywords: Vitamin D, L-fucose, Protein binding Fucose, Lipid Binding Fucose

1. Introduction

Vitamin D(Vit-D) is a fat soluble vitamin that acts as a steroid hormone, with an important role in the organization of many biochemical processes by their link with the receptors of vitamin D. Vit-D plays a significant role in immune defense, bone metabolism, calcium homeostasis, cardiovascular function, and cancer[1,2]. Recently many researchers studied the prevalence rate of Vit-D deficiency (VDD) worldwide[3], which correlated with several health outcomes such as Non-skeletal complications include cardiovascular diseases (peripheral vascular disease, myocardial infarction, and hypertension)[4-7], and also related with rheumatoid arthritis, cancers, inflammatory bowel diseases and musculoskeletal (bone fractures, rickets, osteopenia, osteomalacia, muscle weakness, and osteoporosis)[8,9]. In spite of that, the importance of VDD is yet under investigation [10], but the low level of vitamin D is come out as a so prevalent condition all over the world, and various studies have shown a high correlation with acute and chronic diseases[11].

Fucose (also known as 6-deoxy hexose in the l-configuration) is an unusual deoxy-monosaccharide that is present in different mammalian cells as glycolipids and glycoproteins, which is found in 7.2% of mammalian oligosaccharides studied, so it is a relatively widespread component of glycan alterations on lipids and proteins[12,13]. Which is combined into glycolipids, O-glycans, and N-glycans by importance transferase enzymes (13 fucosyltransferases) In mammals. The fucosyltransferases (FUT13/POFUT2, FUT12/POFUT1, and FUT8), are main for suitable growth in mice, and the alteration of fucose has also been involved in numerous other physiological functions including improving the immune defense and also in cancer [12]. In which many researchers reported an elevation in serum fucose level in different pathological states such as osteomalacia and rickets[14] , cirrhosis liver[15], cardiovascular disorders-CVD [16] and cancer such as ovarian and breast cancer[17,18], brain tumors[19] and leukemias[20] .

The objective of the study is to assess the level of free fucose, and fucose conjugated with lipids and proteins in sera of patients with Vitamin D deficiency.

2. Subjects and Methods

-Subjects: Sixty-one serum samples were collected in the present study, thirty-five of them are patients (11 female and 24 male) with Vitamin D deficiency, age ranged (35-73) year collected from Samarra general hospital in Samarra city, and twenty-six were apparently healthy person as a Cg, all the samples were collected from the period between 1st February to the end of March 2021.

3. Methods

Determination of serum concentration of Vitamin D which carried out by using enzyme linked immunoassay method-ELISA.

Determination of free serum free fucose (FF) concentration was carried out by using the standard colored spectrophotometric method described in[21] depending on the direct reaction between concentrated ice-cold sulfuric acid with fucose in serum sample in the presence of cysteine reagent, the colored product was measured at (396 -430nm) by spectrophotometer. Different concentration of standard solutions(Fucose) were used to calculate the concentration of free fucose in serum as mg/100 ml.

Determination of protein-bound fucose (PBF)

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concentration was carried out according to the methods of Dische and Shettles[22] .
Determination of serum Lipid-bound fucose(LBF) concentration which was carrid out according Katabodies et al method [23].
-Statistical analysis: Data obtained from the present study were expressed as average±standard deviation (SD) and statistically analyzed by using student-Test (T-Test) by SPSS program, and the significant difference at probability value equal or less than 0.05.
The study was carried out to.

4. Results

The estimation of free fucose, PBF and LBF concentration of in sera of patients with VDD was carried out in the current study. The results indicate that the average of free serum Fucose concentration was (30.834±5.548) mg/dl in patients with VDD and (30.834±5.548) mg/dl in Cg (Table 1 and Fig. 1). While the average of PBF concentration in sera of patients were (5.208±2.585) mg/dl and (3.250±1.225) mg/dl in Cg,Fig2. The study also includes determination of the serum fucose binding with lipids (LBF), the results also indicate that the average were (12.211±5.111) and (6.671±2.039) mg/dl in Pg and Cg respectively, Fig 3.
The classification of groups under investigation were carried out according to the level of vit-D (group of patients include the patients with Vit-D concentration<30 ng/ml and Cg with the concentration > 30 ng/ml). Table 1 show that the average±SD for Vit-D (15.438±5.3408) ng/ml in patients and (28.388±7.881)ng/ml in Cg.

Table1:Serum concentration of Vit- D, FF, PBF and LBF

P-Value	Mean ± SD		Parameters
	Patients(Pg)	Control(Cg)	
0.0001*	15.438±5.3408	28.388±7.881	Vitamin D(ng/ml)
0.0001*	37.960±8.701	30.834±5.548	Free Fucose(mg/dl)
0.006*	5.208±2.585	3.250±1.225	Fucose protein(mg/dl)
0.0001*	12.211±5.111	6.671±2.039	Fucose lipid(mg/dl)

Table 1 showed that the level of FF,PBF and LBF were significantly increased(at probability value ≤0.05) in sera of patients with VDD as compared with Cg , with significant decreased (at probability value ≤0.05.) in the level of Vit-D in patients group comparing with Cg.

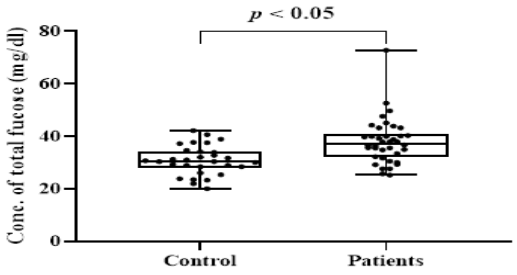

Fig 1: concentration of serum (FF) in patient and contro

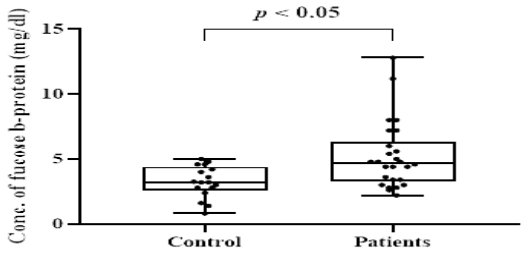

Fig 2: concentration of serum (PBF) in patient and contro

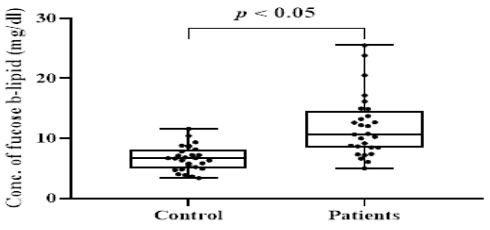

Fig 3: concentration of serum (LBF) in patient and control

5. Discussion

The VDD is correlated with a wide range of infectious and chronic diseases. Many researchers found that VDD was high prevalence in Samarra city, and linked to other diseases such as hyperuricemia, diabetes mellitus, infertility.etc. [24,25].
The fucosylation process is a post-translational alteration of lipids, glycans, and proteins that is in control of a lot of biological pathways. Fucose coupling by alpha(1→3),alpha(1→6), alpha(1→2), alpha(1→4), and O-linkages with glycans, and differences in fucosylation bounds, have a serious effect on cancer[26]. So many studies compare the level of fucosylated glycan and fucose levels in healthy individuals vs patients with different types of cancer, liver, breast, ovarian, lung , prostate, and pancreatic cancer patients[27-32] .
In addition, the elevation in the level of Fucose is not correlated with cancer only but also to many critical diseases such as osteomalacia, COVID-19 and rickets[14,33], CVD [16], and liver cirrhosis [15]. So the deficiency in vitamin D and high level of fucose may-be act as a risk factor for cancer or other disorders such as osteomalacia and rickets and CVD. Although the correlation between the low level of Vit-D and the high level of free and conjugated fucose is still unclear, in which the present study is the first, so is a need for more studies.

6. Conclusion

From all the results obtained from the present study, we can conclude that the high level of fucose and low concentration of Vit-D may be a risk factor to many serious diseases such as bone diseases, cancer and CVD.

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