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Importance of Growth hormone (GH) and insulin like growth factor-1(IGF-1)-1in diabetic patients

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ABSTRACT

This study aimed to determine Growth hormone (GH), Insulin like growth factor- 1(IGF-1), Fasting blood glucose (FBG) and Body mass index (BMI) levels. also to find relations between GH and IGF-1, in addition to GH and IGF-1 with BMI in diabetic patients. A current study included(60) patients (21male:39female) with age (13-74)years, in addition to (30) controls. BMI calculated by weight and length measurement, FBG tested by spectrophotometer and hormones by ELISA technique. Statistical analysis performed by Danken and Minitab ver. 2017. This study revealed a significant decrease ($P \leq 0.05$) in GH concentration in patients (121.2 ±29.1) ML.U/ml than control (150±33) ML.U/ml , female patient than control and in (15-30) and (46-60) years than other age groups .There are significant deference ($P \leq 0.05$) in IGF-1among different age groups, also between male and female patients in IGF-1 in (15-30) years, and between male patients and control in (15-30)years . There is significant increase ($P \leq 0.05$) in FBG in patients (192.7 ±45.2) mg/100ml than control (112.4 ±11.8) mg/100ml. The obesity reported in patients: BMI (30.29 ±6.26)kg/m2 versus control (28.48 ±5.61)kg/m2 but this difference not significant statistically ($P > 0.05$). There are positive relation between GH and IGF-1 (P:0.5, R: 0.283) but negative relations between GH and BMI (P:0.026, R: -0.29) and between IGF-1and BMI (P:0.702, R:-0.051) in patients. The current study concluded a significant decrease in GH but increase of IGF-1 but not significant. The age affects each GH and IGF-1. There are positive relation between GH and IGF-1 but negative relation of BMI with GH and IGF-1.

Introduction

Diabetes mellitus is a group of physiological disorders characterized by high glucose level as a result of defect in insulin production, function or both [26] that produced by pancreas[25]and controls glucose for obtaining energy [20]. Diabetes causes by genetic defects or environmental factors [50] such as obesity [5]and certain drugs [9] .Types of diabetes are type 1DM, type2 DM and gestational DM. Many manifestations associated with diabetes such as polydipsia, polyuria and polyphgia [26]. It diagnosed by HbAlc test (6.5%), FPG>126 mg/100ml, OGTT and RPG > 200mg/100l [2][10] [34][43] . There are about 500000 patients attended health care centers in Iraq yearly [11].

GH is a single chain of 191 amino acids that contains two sulfide bonds, and responsible for growth and metabolism [36]. It produces by pitutary and promote insulin like growth factors (IGFs) secretion from liver, bone and other tissues [27] and promote gluconeogenesis, lipolysis, and protein synthesis in some tissues [15]. GH controlled by hypothalmic Growth hormone releasing hormone GHRH and Growth hormone inhibiting hormone GHIH that controlled by glucose level. There are other GH Promoters and inhibitor such as fatty acids, amino acids, stress and obesity[27]. GH posses diabetogenic role [40]

IGFs are peptides associated with GH and responsible for some anabolic actions of GH . IGFs contains IGF-1 and IGF-2. IGF-1 has same structure of insulin[36] and act some functions of insulin [36] and promote infant longitudinal growth and metabolism [15]. Diabetes decreases IGF-1 [14] [18] but Hamza study [24] reports increase of IGF-1in obese diabetes patient. Also initial puberty increase IGF-1. It used for growth disorder diagnosis [18] [41], and has future role in prevent of diabetes [52] There are negative correlation between IGF-1 and BMI [24].

Glucose is a major energy source for different tissues. It comes from food[9] and internal body production by glycogenolysis and glyconeogenesis[34]. Glucose Controlled by Several hormones such as insulin and GH[21] obesity increases glucose level [3]and glucose increases with diabetes [6].

Obesity is a BMI level that arrives ≥ 30kg/m2[47]. Food plane and lifestyle have key role in obesity [37]. some gene mutations result in obesity and diabetes [4] .One Iraqi study noted obesity in diabetic patients [1]. There is recent Iraqi study reported negative relation between IGF-1 and BMI in diabetic patients [24].

The aims of a current study are to determine GH, IGF-1, FBG and BMI levels, also to reveal relations of GH with IGF-1 and BMI with GH and IGF-1

Materials and methods

A-Methodology

A-1:Patients and control persons

This study performed on (60) diabetic patient (21 male ; 39female) with age (13-74) years in Al-Duloya in Salahaddin province, some of them is attended Al-Duloya hospital in Iraq but other by going to their living places, in addition to (30) control persons (15male; 15female) their age (16-57) years. The period of study continued from25/9/2017 to 9/2/2018.

A-2: Questionarie

It contains: Age, sex and disease type (I or II), in addition to anthropology measurements and biochemical parameters.

A-3: Anthropology measurements

Its contain weight , height and BMI

A-4:Biochemical investigations:

After obtaining (5-9) ml fasting venous blood and extraction of serum the following parameters investigated: FBG, (spectrum, egyption kits) by Japan Apel spectrophotomete, GH (USA Monobind kit) and IGF-1 (Jermany demedatic kit) by USA biotech ElISA.

A-5: Mathematic calculations :

BMI calculated by equation .

BMI = Weight (kg)/Length^2 (m) [51]

B. Statistical analysis

Danken and Minitab ver.2017 used for statistical analysis .

Results and dissusion

Growth hormone (GH)

Figure (1) describes levels of GH in diabetic patients and control , it reveals significant decrease (P≤0.05) in patients than control. This result is agreements with Mamza YP. et. al (2013) who found the same decrease in type II diabetes. Growth hormone inhibiting hormone (GHIH) elevated with hyperglycemia there for decrease GH secretion [27] also some circulation defects that associated with diabetes cause hypopitutarisim [35] affecting GH level [40] GH decreases by obesity [22] and patients in this study are obese as in fig (9). Also figure (1) reveals significant decrease (P≤0.05) in patient females than control females and no significant difference (P>0.05) in patient males. This result agreements with Asplin CM et al(1989) [21] who found same difference in type I diabetic males. Figure (2) reveals that (15–30) years and (46-60)years age groups reported a higher level when compared with (31-46) and (61-75) years age groups. This result agreements with Russell- Aulet M et al (2001) [42] who found that GH decreases with age propression in healthy persons. GH level decreases with age as a result of it is secretion impairement [40] Estrogen and endrogen elevate in adults causing decrease GH [7], but estrogen and testosterone decrease in aging persons [13] [35] there for GH may be elevates in (46-60) year group.

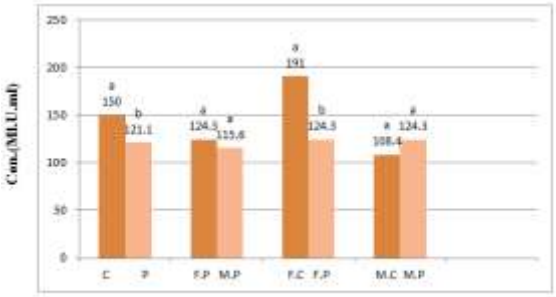

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Figure (1): Levels of GH in diabetic patients and control

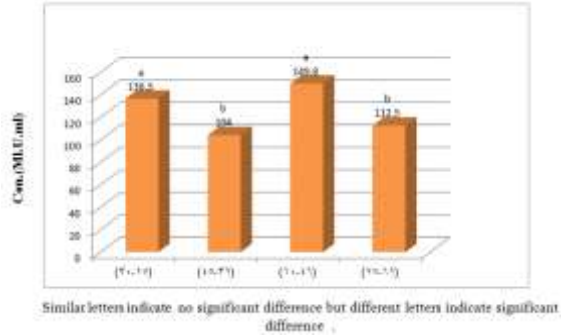

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Figure (2) : Levels of GH in diabetic patients according to age groups

Insulin like growth factor-1 (IGF-1)

Figure (3) reveals differences between patients and control, male patients and control, female patients and control and between male and female patients but not significant statically (P>0.05). These are in normal values (20-350)ng/ml [31] [44]. This study agreements with Drogan et al(2016) [19] who found no relation between IGF-1 level and type2 diabetes

but different than Teppala et al(2010) [46] study who found decrease in IGF-1 level in diabetes .

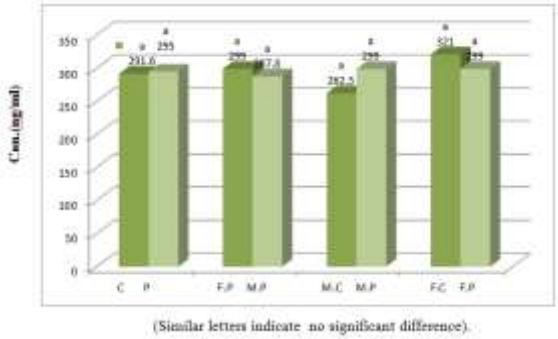


Figure (3) : levels of IGF-1 in diabetic patients and control

In some diabetic patients IGF-1is increases [30] and it has same action of insulin [13] there for may be increased in patients of this study to decreases glucose in stead of insulin. The differences between male and female patients, male patient and control and female patients and control in IGF-1where associated with GH differences as in fig (1) and (3), as aresult for positive relation between GH and IGF-1[22]. Figure(4) reveals significant decrease (P≤0.05) in IGF-1 with age progression in diabetic patients. This results agreements with Russel-Allet (2001)[42] study that found IGF-1 decrease with age in healthy persons. Most patients in this study are adults , there for GH decrease because adult hood [7] and GH decreases causes IGF-1 decrease [22] . This results different than Teppala et al(2010) [46] results, who found decrese of IGF-1 in < 65years and increase of IGF-1 in > 65 years in diabetic patients. Figure(5) reveals significant increase (P≤0.05) in IGF-1 in males than females in patients in (15-30)years and no significant differences (p>0.05) in other age groups . These results different from Teppala et al (2010) [46] results that found decrease of IGF-1 in adult patients. post puberty males have higher longitudinal growth than females and IGF-1 stimulated by GH [13] there for IGF-1 may be increased in (13-15) years males. In other age groups IGF- 1 not affected according to gender in patients because of positive relation with GH [22] that not affected statistically, as in fig.(1).

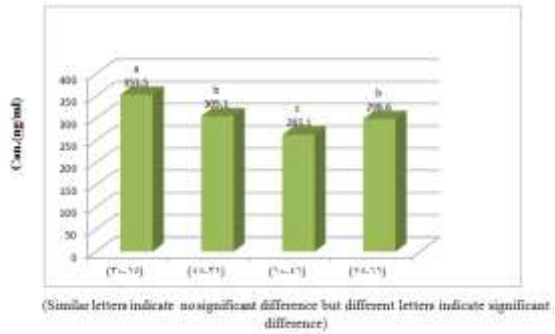


Figure (4): Levels of IGF – 1 in diabetic patients according to age groups

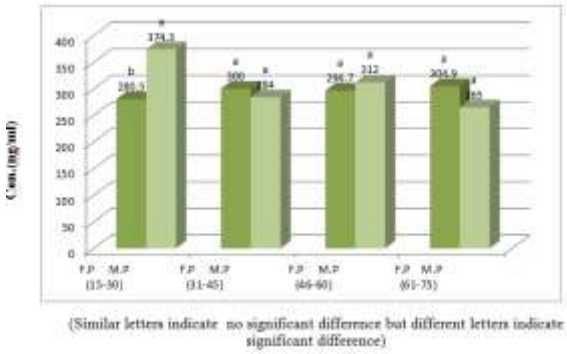


Figure (5): Levels of IGF – 1 in male & female diabetic patients according to age groups .

Glucose :

Figure (6) reveals significant increase (P≤0.05) in patients FBG than control. This result agreements with Al-Jubori (2016)[6] who found significant increase in FBG in diabetic patients. Diabetes caused by genetic defects in certain gens in addition to environmental factors and may be defect in pancreas or other endocrine glands [49] Also obesity cause insulin resistance and diabetes [31].

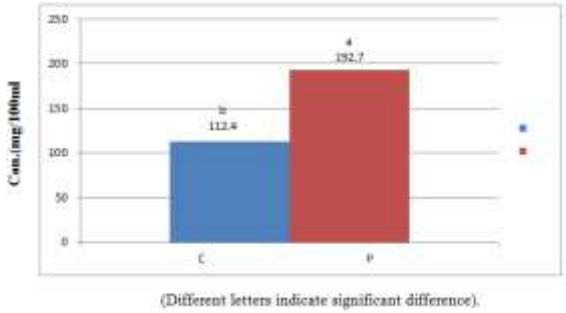


Figure (6) : FBG levels in diabetic patients and control

Body mass index (BMI)

Fig (7) reveals high BMI (obesity) in diabetic patients compared with control but not statistically significance. (p>0.05). Each person has BMI >30 kg/m2 concern obese [34]. This result agreements with Abd – Alkhaliq (2011) [1] result that reported obesity in diabetic patients. Obesity causes insulin resistance that cause diabetes[26] .

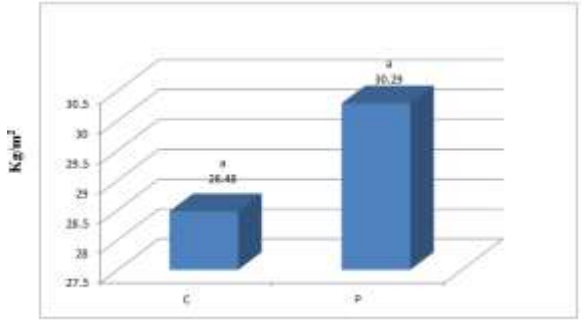


Figure (7) BMI in diabetic patients and control

Correlation between GH and IGF-1

Figure (8)reveals Positive correlation between GH and IGF-1 (P:0.5, R:0.283) in diabetic patients. This

result agreements with Lang et al(2000) [29] result that reports same positive correlation between GH and IGF-1 in rats. The cause of positive correlation is that IGF-1 promotes by GH [17].

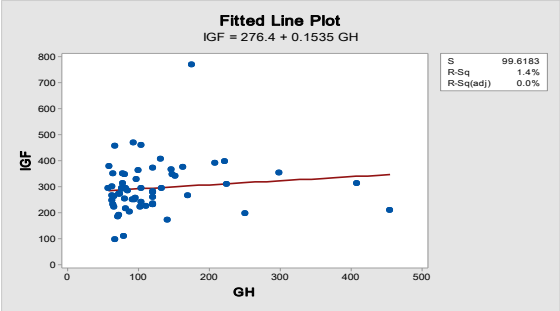
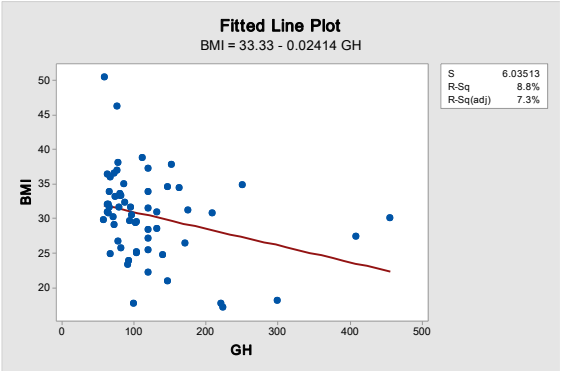


Figure (8) : Correlation between GH and IGF-1 in diabetic patients

Correlation of GH and IGF-1 with BMI

Figures (9) and (10) reveal negative correlation of GH and IGF-1 with BMI (P:0.026,R:-0.29) and (P:0.702,R: -0.051). These results agreement with Tzanella et al(2010)[48] results that reports same negative correlation between GH and BMI in diabetic patients and agreements with (Hamza,2012) [24] results that report negative correlation between IGF-1 and BMI but differs from Tahir and (Ahmed,2012) [45] result that reports positive correlation s of GH and IGF- with BMI when studying GH deficiency patients. GH decreases by hyperglycemia [27] then IGF- decreases [22] Also GH decreases by obesity [40].



Figure(9): Correlation between GH and BMI in diabetic patients

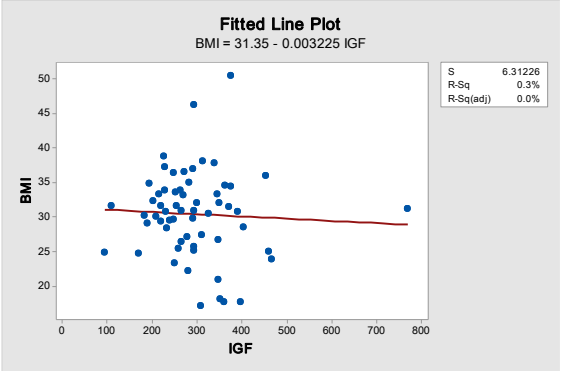


Figure (10): Correlation between IGF-1 and BMI in diabetic patients

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أهمية هرمون النمو GH وعامل النمو الشبيه بالأنسولين من النمط الاول IGF-1 عند مرضى داء السكر

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الملخص

هدفت الدراسة الحالية الى قياس مستويات هرمون النمو Growth hormone (GH) وعامل النمو الشبية بالانسولين من النمط الاول Insulin like growth factor- 1(IGF-1) وكلكوز الدم الصيامي Fasting blood glucose (FBG) ومؤشر كتلة الجسم Body mass index (BMI) وإيجاد العلاقات بين GH و IGF-1 وبين BMI و GH و IGF-1 في مرضى داء السكر، وتضمنت (60) مريضاً(21 ذكور : 39 أناث) أعمارهم (13–74) سنه و(30) اصحاء. حسبت BMI بقياس الوزن والطول، وتم تقدير FBG بجهاز المطياف و GH و IGF-1 بتقنية ELISA. أجري التحليل الاحصائي ببرنامجي Danken و Minitab.Ver.2017. كشفت نتائج الدراسة أنخفاضاً معنوياً (P≤0.05) في GH عند المرضى (121.2±29.1) مايكرولتر .وحدة دولية/مل مقارنةً بالأصحاء (150±33) مايكرولتر. وحدة دولية/مل وعند المرضى الاناث مقارنةً بالصحيحات، وزيادة معنوية(P≤0.05) في الفئات العمرية (15–30) و (46–60) سنة مقارنةً بالفئات الأخرى، وجد اختلافاً معنوياً (P≤0.05) في IGF-1 بين المجاميع العمرية المختلفة وبين الذكور والإناث المرضى في IGF-1 في الفئة (15–30) سنة، وبين المرضى والأصحاء الذكور في الفئة (15–30) سنة. وجدت زيادة معنوية (P≤0.05) في FBG عند المرضى (45.2 ±192.7) ملغم/ 100مل مقارنةً بالأصحاء (11.8 ±112.4)ملغم/100مل، ولوحظت البدانة عند المرضى BMI(6.26 ±30.29) كغم/م2 مقارنة بالأصحاء (5.61 ±28.48) كغم/م2 لكن هذا الاختلاف ليس معنوياً (P>0.05)، ولوحظت علاقة ايجابية بين GH و IGF-1 (P:0.5 , R: 0.283) وعلاقات سلبية بين GH و BMI (P:0.026 , R: -0.29) وبين IGF-1 و BMI (P:0.702 , R: -0.051) عند المرضى. استنتجت هذه الدراسة انخفاضا معنويا في GH وزيادة في IGF-1 لكنها غير معنوية ولوحظ تأثير العمر على مستويات تلك الهرمونات، ووجدت علاقة ايجابية بين GH و IGF-1 وعلاقات سلبية بين BMI و GH و IGF-1.