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Comparison the level of parathyroid gland hormone and body mass index normal in Iraqi population in age between (4-20) year with their reference values

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Abstract: This study aimed to compare between PTH level and BMI in female and male separately then the results were compared between female and male. The aim of this study is to know the cause of differences in hormone elevation and weight in female compared with male for the same age (4 – 20) year old in Iraqi society and the effect of stress, physiological change on these results. A descriptive approach has been used in this study to research analysis, two variables were used: PTH, BMI.

The conclusion of this study is that: there is an elevation in female serum PTH level with elevation in their weights in ages (4 – 9), (10 -14), (15 – 20) year, when these results compared with the results from male in the same age it's clear that they were higher, so; the handling of this issue by interesting in sport in ordinary life and in school and consideredit an important lesson Based on direction of education ministry.

Keywords: PTH (PARATHYROID HORMONE), BMI (BODY MASS INDEX), comparison, Iraq

مقارنة مستويات هرمون الغدة جنب الدرقية مع وزن كتلة الجسم الطبيعية في المجتمع العراقي بالنسبة للعمر بين (4- 20) سنة مع القيم المرجعية

سفانة معن عبد الحسين

شركة ابن سينا للصناعات التعدينية || وزارة الصناعة والمعادن || العراق

الملخص: هدفت دراستنا إلى المقارنة بين مستوى هرمون الغدة جنب الدرقية والوزن في كل من الإناث والذكور كل على حدا ثم مقارنة النتائج المستحصلة ما بين الإناث والذكور، لمعرفة سبب اختلاف ارتفاع نسبة الهرمون والوزن للإناث مقارنة بالذكور لنفس الأعمار من (4 – 20) سنة في المجتمع العراقي ومعرفة كيف تؤثر الضغوط النفسية والتغيرات الفسيولوجية على هذه النسب في الإناث. تمت الدراسة باستخدام المنهج الوصفي التحليلي حيث تم تنظيم استمارة تحتوي على متغيرين هما (PTH) و (BMI) واستنتجت الدراسة أنه بزيادة مستوى هرمون الغدة جنب الدرقية في مصل الإناث تقابلها زيادة في أوزانهن للأعمار (4 – 9) (10 – 14) (15 – 20) سنة، ثم مقارنة هذه النتائج مع الذكور لنفس الأعمار أعلاه وقد تبين أن النتائج للإناث كانت أعلى منها في الذكور. وبناء على نتائج الدراسة فإن معالجة هذه المشكلة يكون في الاهتمام بالرياضة في الحياة اليومية وفي المدارس حيث يجب اعتبارها مادة تربوية مهمة وتقع هذه المسؤولية على وزارة التربية والتعليم حصص الرياضة المدرسية.

الكلمات المفتاحية: (PTH) هرمون الغدة جنب الدرقية، (BMI) كتلة وزن الجسم، مقارنة، العراق

Introduction

The Parathyroid glands are small endocrine glands in the neck. They produce Parathyroid hormone, usually they consist of four Lobes, which are located on the rear surface of the thyroid gland or in rare cases, within the thyroid gland itself in the chest Which gives the gland the appearance of a butterfly as shown in Figure (1) (1).

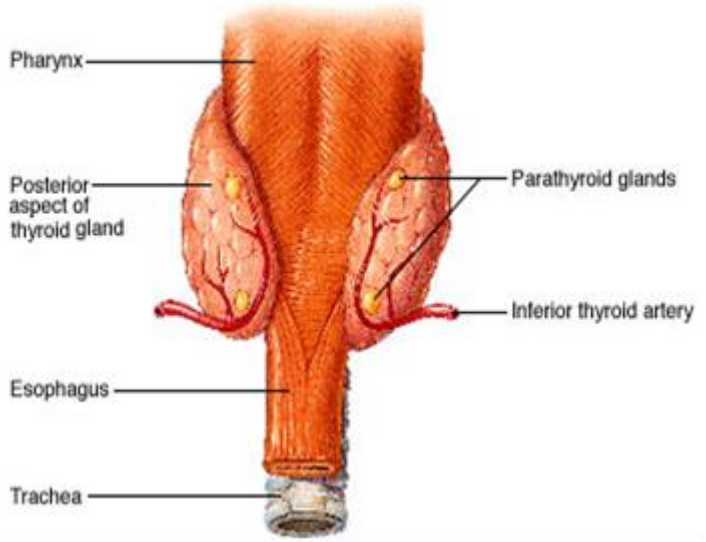

Figure (1) Anatomy of parathyroid glands.

The Parathyroid glands are embedded in the posterior part of the thyroid gland (2).

The Parathyroid glands usually weight between 25 mg and 40 mg in humans there are typically part on above the other, on the left lobe of the thyroid gland and similarly on the right (3).The parathyroid glands are quite easily recognizable from the thyroid as they have densely packed cells, in contrast with the follicle structure see figure (2) of the thyroid (4).

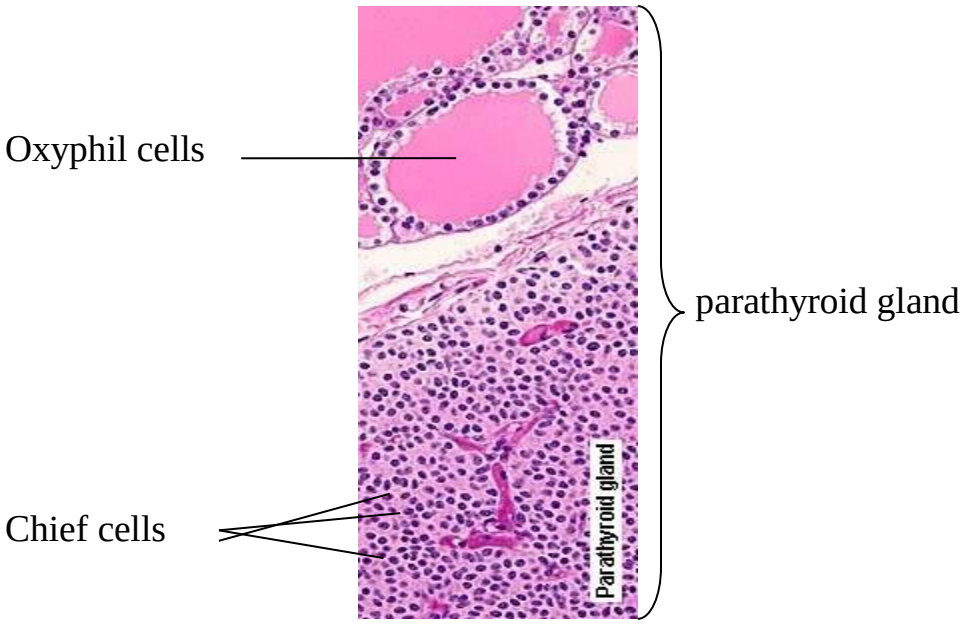

Figure (2) Histology of Parathyroid glands, the parathyroid glands are composed of two densely packed cords of cells (1).

In the histological sense, they distinguish themselves from the thyroid gland, as they contain two types of cells chief cells and oxyphil cells (5) (6).These cells varies in size, function and other properties as shown in table (1) and figure (2).

Table (1) types of cells in parathyroid glands

Name	Staining	Quantity	Size	Function
Parathyroid chief cells	Darker	Many	Smaller	Manufacture PTH
Oxyphil cells	Lighter	Few	Larger	Function unknown

The major function of the parathyroid glands is to maintain which body of the calcium normal level through secretion parathyroid hormone (PTH), which is polypeptide hormone within a very narrow range (13.7-75)pg/ml by which nervous and muscular systems can function properly (7).

When blood calcium level drop below a (13.40-75.1)pg/ml, calcium- sensing receptors in the parathyroid gland will active parathyroid gland to release the to the blood (8) (9).

Parathyroid hormone increases gastrointestinal calcium absorption by activating vitamin D and promotes calcium reabsorption by the kidneys.PTH effects the perception of well-being and absence of PTH can be associated with feeling of fatigue and anxiety (10) (11).

Parathyroid hormones structure of Peptide, target tissue Bone, Kidney small intestine Increased rate of breakdown of bone by osteoclasts, increased reabsorption of calcium in kidneys, increased absorption of calcium from the small intestine, increased vitamin D synthesis, increased blood calcium levels.

Body Mass Index (BMI) is an indirect way to assess body fat and is calculated by dividing weight by height squared (6). In a clinical setting BMI is a useful tool in assessing children's weight status, but additional clinical information is useful in making the diagnosis of obesity, for children aged 2 to 20 years, age –and gender specific references for BMI exist, espied equation which widely used in clinical diagnoses and very reliable for calculating BMI:

$$BMI = \frac{weight\ (kg)}{height\ (m) \times height\ (m)}$$

The medical complication of obesity usually seen in adult but now begun to appear in children and adolescent as well as hypertension and diabetes type 2 (29) (30).

REGULATION OF PTH SECREATION:

Secretion of Parathyroid hormone is controlled chiefly by serum [ca^{2+}] level through negative feedback. mechanism calcium- sensing receptors (CaR) located on Parathyroid cells are activated when [ca^{2+}] level is low (10) (12).Calcium- sensing receptors (CaR) are G protein- coupled cell- located on of the PTH surface receptor that binds calcium ions and stimulus chief cells to release PTH.

In Parathyroid gland, the calcium- sensing receptor (CaR) regulates the secretion of Parathyroid hormone (PTH) in response to changes in extracellular calcium in addition the calcium- sensing receptors is prominently expressed in the kidney where is regulates the handling of calcium in the renal tubules (31) (32). (33). The calcium- sensing receptors may participate in the regulation of bone turnover, renal production of 1, 25- dihydroxy vitamin D, and gastro intestinal calcium absorption (31) (32).The amino acid sequence of PTH shown in figure (3).

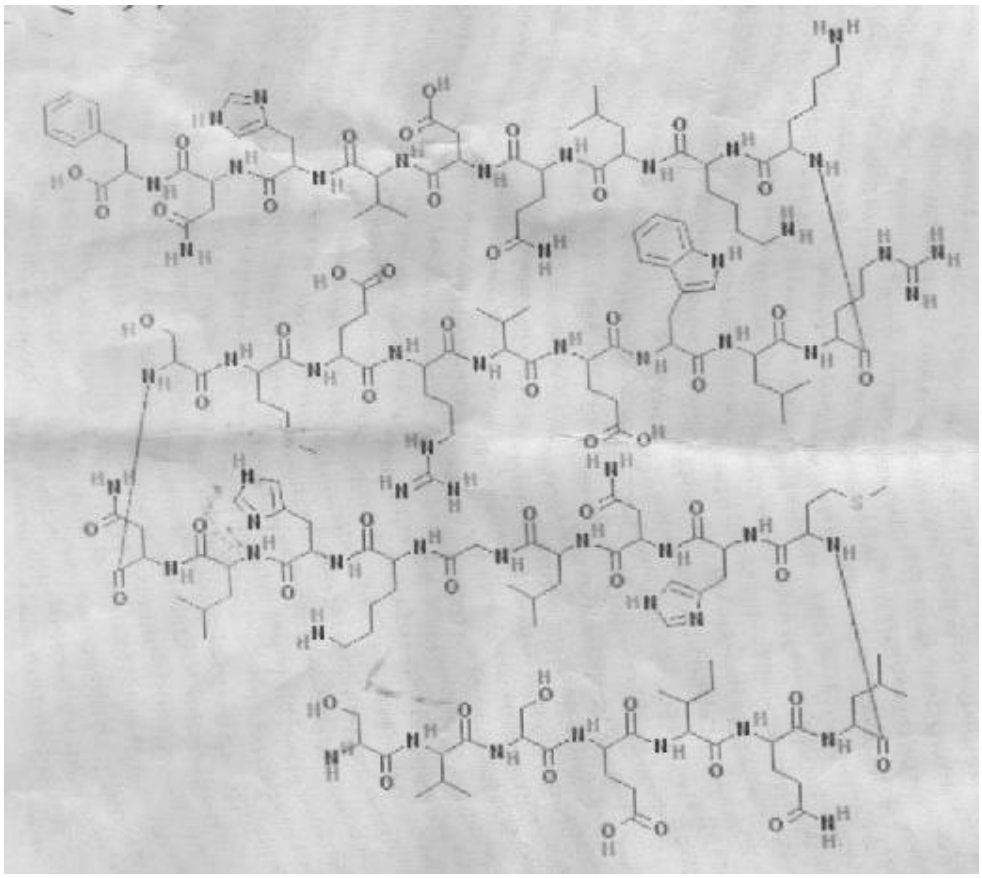

Figure (3) 182 amino acid sequence of Parathyroid hormones (11).

CLINICAL SIGNIFICANT OF PTH

HYPERPARATHYROIDISM

The excessive production of parathyroid hormone (PTH), is usually due to the presence of a functioning parathyroid adenoma but can be to parathyroid hyperplasia or to ectopic production of (PTH) in a malignant tumor. The biochemical hallmarks of hyperparathyroidism are elevated serum ionized calcium and PTH and depressed phosphate levels. In long-standing hyperparathyroidism, findings include extensive restoration of bone (13) (10), is usually due to the presence of. Characterized by weakness and fatigue, depression, bone pain, muscle soreness (myalgias), decreased appetite, feelings of nausea and vomiting, constipation, polyuria, cognitive impairment, kidney stones and osteoporosis(14) (15). The usual cause of hyperparathyroidism such as:

a. Hyperplasia.
b. Parathyroid adenoma.
c. Parathyroid Carcinoma (16).

.HYPOPARATHYROIDISM

Insufficient amounts of PTH result in hyperparathyroidism. The biochemical hallmarks of this condition are decreased serum ionized calcium and elevated serum phosphate levels. Symptom include neuro muscular irritability which, when mild, causes cramps and tetany (28)

, tingling lips and fingers, pain in the face, scaly skin, cataracts and weakened tooth enamel (in children) (17).The usual cause of hyperparathyroidism such as:

a. Removal of the parathyroid glands in thyroid surgery.
b. Autoimmune hypoparathyroidism.
c. Hemochromatosis.
d. Magnesium deficiency.
e. Disgorge syndrome (10).

HORMONAL CONTROL SYSTEMS

Three hormones that control fluxes of calcium and phosphorus in and out of blood and extracellular fluid:

1- Parathyroid hormone serves to increase blood concentrations of calcium. PTH preserves blood calcium by several major effects:
   a. Stimulates production of the biologically – active form of vitamin D within the kidney.
   b. Facilitates mobilization of calcium and phosphate From bone (34).
2- Vitamin D acts to increase blood concentration of calcium. Vitamin D is facilitate absorption of calcium from the small intestine. In concert with PTH, vitamin D also prevent fluxes of calcium out of bone (35)
3- Calcitonin: Is hormone that functions to reduce blood calcium levels, and has at least two effects:
   a. Suppression of renal tubular reabsorption of calcium.
   b. Inhibition of bone resumption, which would minimize fluxes of calcium from bone into blood (36): see Figure (4)

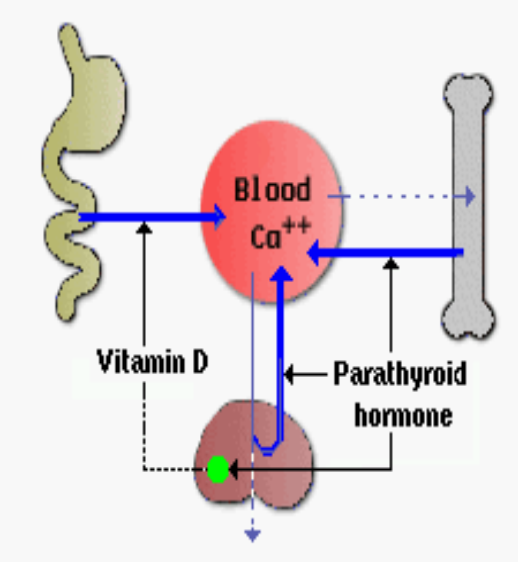

Figure (4) Hormonal control systems

RELATIONSHIP BETWEEN PTH AND GROWTH IN HEALTHY CHILDREN

Parathyroid hormone (PTH) plays an important role in calcium homeostasis by maintaining the concentration of ionized calcium within the precise limits necessary to achieve metabolic and neuroregulatory functions of this essential mineral (18) (19) (20). PTH produces calcium mobilization from the large skeletal stores into the extracellular fluid, increases absorption of dietary calcium and decreases renal clearance of urinary calcium (20) (21).

Experimental

A. Materials and instruments

Sera, Biotinylated antibody, Enzyme labeled antibody, stopping solution, Distilled water

Centrifuge, incubator, Mini vidas.

METHOD

1. Sutticientstreptavidin Coated Strips were placed in a holder to run six (6) PTH calibrators Quality Control sera and samples.
2. Pipet 25µLof sample into the designated or mapped well.
3. 50 µL, of Reagent A (Biotinylated Antibody) added into each of the wells.

4. 50µL of reagent B (Enzyme Labeled Antibody) added into each of the same wells.The micro plate covered with aluminum foil, and place in rotator set at 170 rpm for 3 hours at room temperature (22 – 28^0 C).
5. First separate the fluid completely and then washed theseparate each well five times with the working wash solution (Prepared from Reagent A) using an automatic micro plate washer. Volume of wash solution o.35 ml into each well.
6. 150µLof the reagent B (TMB substrate)added into each of the wells.
7. Place the micro plate with an appropriate cover (S) on an rotator set at 170 rpm for 30 minutes at room temperature (22- 28^0 C).
8. 100 µL of the stopping solution added into each of the wells and mixed gently.
9. The absorbance of the solution in the wells read within 10 minutes using a micro plate reader set to 450 nm against 250 ml of distilled water.

N.V.: (13. 7 – 75.1) Pg / ml

Results

According to the procedure which has been followed in this study, I have reached to the following results:

The useful of measuring PTH level in serum in healthy persons is to comparison hormone levels between male and female in the ages (4-9), (10-14), (15-20) year and how can use this difference to comparison with their reference values. This comparison based on PTH serum level, age, sample size, means ± SD, standard error of mean, Range, Degree of freedom, t-test, and probability, as shown in Table (2, 3)and figure (5).

Table (2) Biostaitistical Calculation * and studied-test for serum PTH of normal healthy person in (female and male).

Parathyroid hormone (PTH) pg/ml	4-9 years		10-14 year		15-20 year	
	Female	Male	Female	Male	Female	Male
Sample size	19	17	37	40	17	17
Means ±SD	85.89±21.11	46.8±19.4	94.21±17.50	40.49±17.94	86.12±20.18	42.61±15.27
Standard Error of Mean	4.86	4.72	2.87	2.83	4.89	3.7

Parathyroid hormone (PTH) pg/ml	4-9 years		10-14 year		15-20 year	
	Female	Male	Female	Male	Female	Male
Confidence interval of mean	76.17-95.16	37.43-56.31	88.38-99.95	34.83-46.15	76.34-95.9	35.21-50.01
Range	15-75	13.8-60	13-75	16.6-58.3	15.8-73	15.9-64.2
Degree of freedom	34		75		32	
t-test	5.76		13.56		7.33	
Probability	0.001		0.001		0.001	

Table (3): Biostaitistical Calculation * and studied-test for serumBMI of normal healthy person in (female and male).

BMI (Kg/m^2)	4-9 years		10-14 year		15-20 year	
	Female	Male	Female	Male	Female	Male
Sample size	19	17	37	40	17	17
Means ±SD	33.4± 2.37	19.1± 2.71	39.18± 2.83	19.91±4.46	42.04± 2.08	23.65± 2.4
Standard Error of Mean	0.54	0.65	0.46	0.7	0.5	0.6
Confidence Interval of mean	32.32-34.48	17.8-20.4	38.26-40.1	18.51-21.31	43.04-41.04	24.85-22.45
Range	14.24-31.72	13.44-25.72	14.9-33	15.38-26	18-35	17-25.5
Degree of freedom	34		75		32	
t-test	17.02		22.6		24.19	
probability	0.001		0.001		0.001	

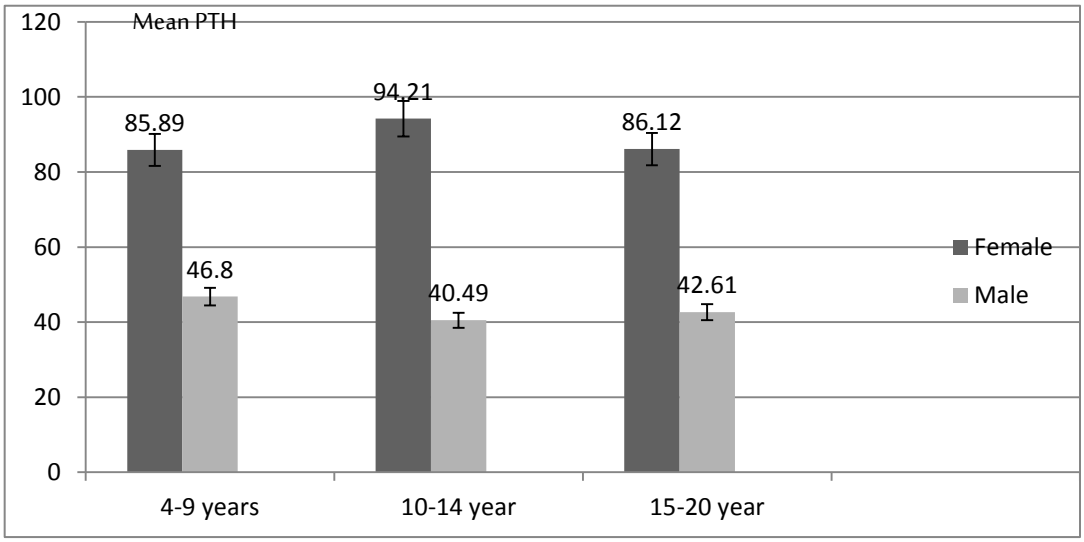

Figure (5) PTH level in normal healthy person, 4-9 years (female &male), 10-14 year (female &male), 15-20 year (female &male) (mean ±SD).

BMI measuring useful for comparing normal healthy persons females with males in the ages (4-9), (10-14), (15-20) year and how can use this difference to comparison with their reference values. This comparison is base on BMI, age, sample size, means ± SD, standard error of mean, Range, Degree of freedom, t-test, and probability, as shown in Table (3) and figure (6).

DISCUSSION

In my study PTH and BMI based on sera of healthy persons for females and males in ages (4-9), (10-14), (15-20) year.

Parathyroid hormone (PTH) and calcitonin (CT), with specific target tissues (kidney, bone, and intestine) which serve to increase or to decrease the entry of calcium in to the extracellular space (22) (23).

The difference in level of PTH between females and males, due to the PTH highest in females may have been affected by the mineral content in food recently ingested; this may partly explain why an initially elevated PTH was found normalized in some of the subjects (24). Would suggested poor of level vitamin D in females caused to elevate of PTH to maintaining of level calcium ion normally.

Data from the National Diet and Nutrition Survey show that the mean daily intake of vitamin D for adolescents age (11-18)year in the UK is (26 µL) (25).

Table (3.1) and figure (3.1) which explain level of PTH in females in age (10-14) year shown highly significant elevation in serum level of PTH when compared with level of PTH for males in same age (p=0.001).

Table (2) and figure (5) which explain level of PTH in females in age (15-20) year shown highly significant elevation in serum level of PTH when compared with level of PTH for males in same age (p=0.001)>.

Elevated PTH concentration in females when compared with males in age (10-14) year and (15-20) year respectively, there is also some suggestion that intakes of vitamin D may be worse in females than males, therefore when vitamin D deficiency elevates PTH which, in turn increases bone turnover and bone loss, contributes to mineralization defects and increases risk of hip and other fractures (26). But elevated PTH concentration may not be driven by the same mechanism in adolescents as in adults, and may not necessarily be detrimental to bone health, for example, serum PTH concentration are normally raised during adolescence (27). Would suggest elevating of PTH concentration in females due to menstrual cycle.

Body mass index (BMI) takes into account weight and height: it is calculated as weight (Kg) divided by squared height (m^2). BMI has been shown to strongly correlate with adiposity in adults and children (37).

Table (3) and figure (6) which explains of BMI in females in age (4-9) years shown highly significant elevation in BMI when compared with BMI for males in same age (p=0.001).

Table (3) and figure (6) which explains of BMI in females in age (10-14) year shown highly significant elevation in BMI when compared with BMI for males in same age (p=0.001).

Table (3) and figure (6) which explains of BMI in females in age (15-20) year shown highly significant elevation in BMI when compared with BMI for males in same age (p=0.001).

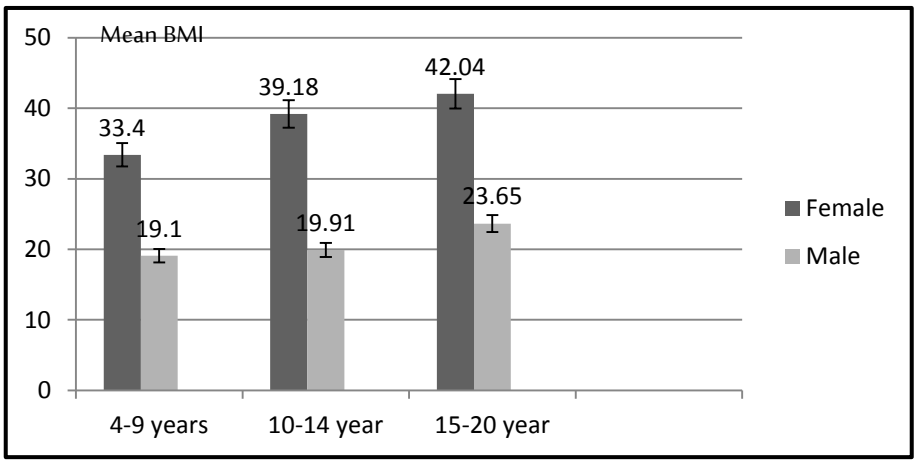

Figure (6) BMI in normal healthy person, 4-9 years (female & male), 10-14 year (female & male), 15-20 year (female & male) (mean ±SD).

For varied ages for females and males the BMI differences due to increases weight begin at the 4-years and above, sex differences in BMI at each level of education were stable over time (38). This would suggest that Iraqi females are not inherently more vulnerable to weight gain but may be more vulnerable

during "critical periods such as puberty or pregnancy in period of adolescent but in childhood the females more vulnerable to weight gain because of caloric intake fat intake, but the difference of BMI between females and males in Iraqi population due to the active physiology for males more than females because of Iraqi population tradition.

From this study I conclude that the (PTH, BMI) levels in females and males for Iraqi population subject with age (4-20) year was with the normal values in comparison with normal values (kit – s) because they were healthy.

PTH associated with body mass index BMI and their predicting role in obesity. PTH has a significant positive relation to BMI in both genders, BMI was higher value when PTH level was high (39).Furthermore, serum PTH decreases with weight loss in obese subjects both on a low-calorie diet. The amount of exercise affects PTH response: moderate exercise suppresses PTH secretion, while strenuous exercise is apt to induce continuous secretion (40). The amount of exercise affects PTH response: moderate exercise suppresses PTH secretion, while strenuous exercise is apt to induce continuous secretion (41) (42).

CONCLUSION

Within its scope and the procedures followed, the results of this study leads to the following conclusion.

There is an increase in the level of parathyroid hormone (PTH) and body mass index (BM I) in females in ages (4-9) years, (10-14) year, (15-20) year respectively.

I appeal through this search Ministry of Education and every constituency to take care of The Sport lesson in schools and in kindergarten primary importance because it has a great impact in good performance and Student thinking generally and the students privately similar to developed countries. As this research Opens the horizons for Study and research in:

1. Profile of menstrual cycle in all phases for females adolescent.
2. Profile of PTH levels in all stages of chronic kidney disease.
3. Profile of vitamin D deficiency in children.

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https: //www.ncbi.nlm.nih.gov/pmc/articles/PMC2723353/

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