

# The Association between Self-reported Sleep Quality, Ghrelin hormone and Obese Children and Adolescents.



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## Abstract

**Background:** Sleep quality, ghrelin hormone and obesity are associated with metabolic syndrome.

**Objective and hypotheses:** To study associations between sleep duration, level of ghrelin and obesity in children and adolescents.

**Method:** A prospective study was conducted on 50 children (their mean age: 8.7±3.2 years) with simple exogenous obesity (BMI SDS >2) recruited from Diabetes Endocrine and Metabolism Paediatric Unit, Children Hospital, Cairo University, Egypt and 60 children age and sex matched as control. Both patients and control groups were subjected to history taking including sleep history, clinical, Anthropometric assessment and laboratory investigations including (serum ghrelin, lipid profile, fasting blood glucose, and serum insulin).

**Results:** According to sleep history; 58% of cases showed interrupted sleep, According to mean number of sleep hours 36% of cases sleep < 6 h, 60% sleep 6–8 h, and 4% sleep more than 8 h. Mean number of sleep hours were significant less compared to the control group (*P* value =0.001). Mean serum ghrelin were significantly higher in cases than control (2.63±1.798 and 1.11±0.412 pg/ml; respectively, *P* value =0.004). Mean HOMA-IR level highly significant more in cases compared to control group (5.05±2.47 and 2.47±0.56, *P* value =0.001). Serum triglycerides was significant higher in cases than control group (*P* value=0.008). There was significant correlation between serum ghrelin level and insulin resistance (*P* value=0.001 and *r*=-0.133). There were non-significant correlation between serum ghrelin level and weight SDS (*P* value=0.18, *r*=0.03), height SDS (*P* value=0.6 and *r*=-0.107), waist to hip ratio circumference (*P* value=0.8 and *r*=0.04), BMI SDS (*P* value=0.3 and *r*=0.004) and serum triglycerides (*P* value=0.6 and *r*=-0.0758).

**Conclusion:** Obese children has short interrupted sleep which leads to increase level of ghrelin hormone and subsequently increase appetite leading to obesity insulin resistance, and hypertriglyceridemia.

## Objectives

To study associations between daytime and nighttime sleep duration and subsequent obesity in children and adolescents. And To study relation between duration of sleep and level of ghrelin hormone

## Methods

**SUBJECTS:** a prospective study was conducted on 50 Children and adolescents with simple exogenous obesity from 1-18 years recruited from Diabetes Endocrine And Metabolism Pediatric Unit (DEMPU), Children Hospital, Cairo University and 70 age and sex matched control

**Exclusion criteria:** Cases of secondary obesity:

**METHODS:** All patients included in the study were subjected to: History including; Nutritional history, sleep history: number of sleep hours (less than 6 hours/ 6-8 hours / more than 8 hours)., pattern of sleep (Continuous or interrupted). Anthropometric assessment (1) Laboratory investigations: including, measurement of fasting plasma glucose, fasting serum insulin (2), assessment of serum Triglycerides (TG): Total Cholesterol, serum HDL-Cholesterol, Calculation of serum LDL-Cholesterol; using Friedwald equation: (3). Ghrelin enzyme is estimated by enzyme immunoassay kit Performed on the TC-96+ by TECO DIAGNOSTICS\*, kits supplied by Ray Biotech. (4)

## Results

The mean age of cases was 8.7±3.2 years (range: 3-14 years), While the mean age of control group was 8.9±3.4 years (range: 4-15 years) (*p*-value =0.9). Male to female ratio was 1:1.6 in cases and 1.2:1 in control (*p*-value =0.2). Positive consanguinity (first and second degree) was reported in 24.0% of cases and 35% in control (*p*-value =0.7).

### Anthropometric data:

The mean height SDS cases was (-0.4±1.3), mean BMI SDS was (4.5± 6.0), the mean waist to hip ratio (0.91 ±0.039), Waist circumference centile was above Ninety Percentile in all cases.

While in control group we found that the mean height SDS was (0.075 ± 1.8), mean BMI SDS was (0.19±0.6), waist circumference centile in range (25<sup>th</sup>-75<sup>th</sup> percentile).

### Table 1: Sleep history in cases and control

	Control group N=60	Cases (obese) N=50	P value
Sleep pattern	Interrupted	29 (58%)	0.001*
	Continuous	21 (45%)	
Number of sleep hours	<6hrs	18 (36%)	0.002*
	6-8hrs	30 (60%)	
	>8hrs	4 (20%)	

*P*<0.05, Significant

### Table 2: Biochemical Laboratory results in cases and control

	Control group N=60		Obese group N=50		P value
	Mean ± SD	Median	Mean ± SD	Median	
Serum Ghrelin (Pg/ml)	1.11 ±0.412	1.08	2.63 ±1.798	1.7	0.004
Serum insulin (IU/dl)	11.86 ± 2.55	12.25	20.56 ± 6.8	19.4	0.001
HOMA IR	2.47 ±0.56	2.51	5.05 ±2.47	4.31	0.001
Fasting blood glucose (mg/dl)	85.6 ± 10.98	84.5	98.38 ± 32.32	92.5	0.08
Total cholesterol (mg/dl)	156.3 ±15.8	154.5	142.67 ± 31.18	138.5	0.06
Serum triglycerides (mg/dl)	67.75 ± 16.8366		100.3 ± 52.8	89.5	0.008

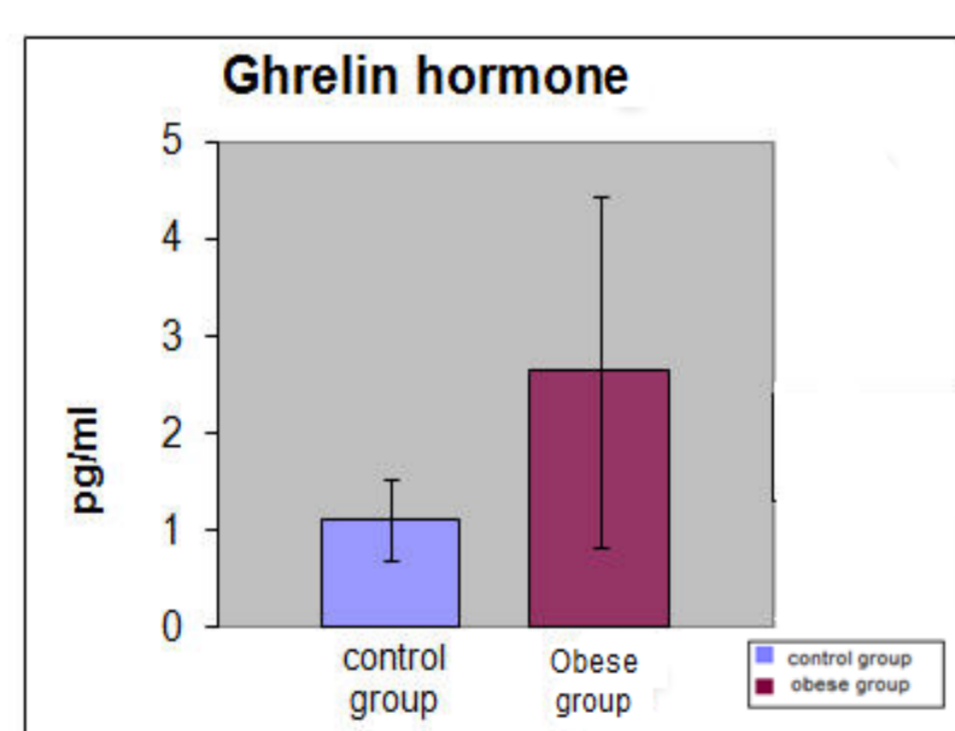


Figure 1: Ghrelin Hormone in cases and control



Figure 2: Sleep history in cases and control

### Table 3: Correlation between anthropometric measurements, biochemical laboratory values and serum ghrelin hormone level in cases

Parameter	R	P value	Parameter	R	P value
Insulin resistance	-0.133	0.001*	T.cholesterol	-0.0363	0.8
HOMA IR			Triglyceride	-0.0758	0.6
HDL	-0.111	0.4	BMI SDS	0.004	0.3
LDL	-0.019	0.8	Waist/Hip ratio	0.04	0.8
Height SDS	-0.107	0.6			

*P*<0.05 (S) = Significant *r* values. 0 indicates no linear relationship. 0 and 0.3 (0 and -0.3) indicate *no* or a *weak* linear relationship. Values between 0.3 and 0.7 indicate a *moderate* linear relationship. Values between 0.7 and 1.0 indicate a *strong* linear relationship.

### Table 4: Correlation between anthropometric measurements, biochemical laboratory values and sleep duration by hours in cases

Parameter	r value	P value	Parameter	r value	P value
Insulin resistance	-0.028	0.8	T.Cholesterol	0.110	0.8
HOMA			HDL	0.008	0.3
Triglyceride	-0.196	0.2	BMI SDS	-0.001	0.8
LDL	0.172	0.6	Waist/Hip ratio	-0.305	0.6

*P*<0.05 (S) = Significant *r* values. 0 indicates no linear relationship. 0 and 0.3 (0 and -0.3) indicate *no* or a *weak* linear relationship. Values between 0.3 and 0.7 indicate a *moderate* linear relationship. Values between 0.7 and 1.0 indicate a *strong* linear relationship.

### Table 5: comparison between subgroups of obese patients according to interruption of sleep

	Continuous sleep subgroup (N=21)		Interrupted sleep subgroup (N=29)		P value
	Mean±SD	Median	Mean±SD	Median	
Weight SDS	4.7 ± 2.1	4.3	4.4 ± 2.2	4.75	0.1
Height SDS	1.2 ± 0.1	0.08	-1.3 ± 0.4	-0.2	0.3
Waist/Hip ratio	0.9 ± 0.03	0.13	0.91 ± 0.04	0.16	0.2
BMI SDS	3.5 ± 0.7	2.5	7.9 ± 5.1	3.45	0.7
Number of sleep hours	6.6 ± 0.9	5.6	5.2 ± 1.08	4	0.2
Age	5.0 ± 2.3	5.2	8.9 ± 3.3	7.9	0.2
Serum Ghrelin	2.8 ± 1.7	2.6	2.3 ± 1.8	1.7	0.3
Serum insulin	13.1 ± 9.35	10.2	12.51 ± 9.2	9.6	0.4
Fasting blood glucose	101.3 ± 41.5	92	93.7 ± 10.4	92.5	0.5
Total cholesterol	143.6 ± 35.9	132	142.5 ± 25.6	142.5	0.7
Serum triglycerides	80.10 ± 49.3	65	54.2 ± 17.5	89.5	0.3
Serum HDL	41.8 ± 8.9	40	43.7 ± 7.5	42.5	0.4
Serum LDL	85.1 ± 34.5	72	87.9 ± 25.9	90	0.1
HOMA IR	0.9 ± 0.03	0.13	5.3 ± 3.0	4.31	1

= Significant *P*<0.05 (S)

## Conclusions

- According to sleep history the number of sleep hours were significant less in obese group compared to control group mean sleep hours in obese group were 5.8 hours while in control group was 8.4 hours.
- There was statistically significant interruption in sleep pattern in obese cases compared to control group.
- A highly significant increase in serum Ghrelin among obese group compared to control group.
- A statistically highly significant increase in HOMA-IR (Homeostasis Model of Assessment - Insulin Resistance) level as indicator of insulin resistance in obese cases compared to control groups.
- Positive correlation between serum ghrelin level and weight SDS, waist to hip ratio and BMI SDS of obese patients.
- Negative correlation between serum ghrelin level and serum insulin among all patients.

## References

- Ghaly Isis, et al., (2002): National Growth Charts for Egypt.
- Global Siemens Healthcare Headquarters, Siemens AG Healthcare Sector, Henkestrasse 127 D-91052 Erlangen, Germany
- Roger Johnson, Prudence McNutt, Stephen MacMahon and Richard Robson, Use of the Friedewald Formula to Estimate LDL-Cholesterol in Patients with Chronic Renal Failure on Dialysis, Clinical Chemistry 1972;18:499-502
- TECO DIAGNOSTICS, 1268 N. Lakeview Ave, Anaheim California, 92807, U.S.A.