



## Obesity as a Threshold of Elevating Insulin and Leptin: A Population Based Cross Sectional Study

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### ABSTRACT

Obesity is a medical condition in which excess body fat has built up to the extent that it can have a negative impact on health and leads to a various diseases and conditions, including cardiovascular disease, type 2 diabetes, obstructive sleep apnea, some types of cancer, and osteoarthritis. This study aimed to evaluate the levels of insulin and leptin in non-obese and obese and its relationship. A total of 331 individuals, age 18 to 65 years (female 212 and male 119) were involved in the study which was conducted in the department of Physiology, Regional Institute of Medical Sciences, Imphal, Manipur, India. Collected blood samples were estimated insulin and leptin levels. All data were calculated the correlations between insulin and leptin. In this study, Insulin and leptin levels were significantly higher in obese compared to non-obese. Females showed significant increase among the groups of non-obese and obese. Data presents correlations between insulin and leptin as well as found relationships among leptin and obese. In this study, we conclude that with increasing insulin and leptin levels in obese, probability to prone prediabetic and other metabolic disorders are more.

**Key words:** Insulin, Leptin, Obese, Manipur

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### INTRODUCTION

The global obesity rate has increased three-fold since 1975, and is now reported to be a leading cause of various immune and metabolic diseases. Therefore, obesity has emerged as a national concern. Based on World Health Organization statistics in 2016, around 2 billion adults worldwide were obese and more than 650 million of them were adults [1]. Obesity has been regarded as a behaviour-related disease, inappropriate food intake with relative lack of activity. Without exact molecular mechanism to explore the pathology, being obesity was just a lack of will [2].

Adipose tissue is a type of energy storage tissue which is strongly linked to obesity, this association considered not only as an endocrine gland, but

also an immune organ that generates multiple types of immune cells, including eosinophil's, neutrophils, mast cells, macrophages, T and B cells [3,4]. Adipocytes produce a various types of cytokines including tumor necrosis factor-alpha (TNF- $\alpha$ ), leptin, IL-6, interleukin (IL)-1 and IL-17 [5,6]. Leptin was discovered in 1994, [7] as an adipocytokines to regulate food intake, body weight, and fat mass, also a major regulator of the immune and neuroendocrine systems, unleashed a tremendous excitation in the study of obesity as a disorder with a potentially molecular mechanism, as well as many new research areas associated with it [2].

Recessive mutations in the ob gene or dysfunction activity of have been linked in mouse models with infertility, severe obesity and insulin resistance [8-10]. Insulin and sex steroid hormones seem to have an impact on the production of leptin. It has been demonstrated that insulin increases levels of ob mRNA in cultured adipocytes and responding to the feeding of rodents and human

models, implying that insulin could directly regulate gene expression and leptin production [11].

Numerous data suggest that insulin and leptin act in adiposity negative feedback signals of the brain [12]. In fact, recent studies have shown that leptin has the effect of normalizing hyperglycaemia and hyperinsulinaemia and increasing insulin sensitivity [13]. Since, the lack of studies related to obesity and its complications among the indigenous people of Manipur, a state in northeast India, this study was aimed to establish the relationship between insulin and leptin in non-obese and obese individuals in Manipuri population.

### MATERIALS AND METHODS

This cross sectional study was conducted in the department of Physiology, Regional Institute of Medical Sciences, Imphal, Manipur, India from March, 2019 to December, 2020. After taking approval from the Institutional Ethical Board, study consent was obtained from the subjects, age 18 to 65 years. Total of 331 participants (both sex) were recruited. Subjects with the history of any chronic metabolic diseases were excluded from the study. Height was measured using portable stadiometer and weight was taken using Tanita weighing scale. Based on

WHO's BMI cut off, study population were grouped (kg/m<sup>2</sup>) as non-obese (<25 kg/m<sup>2</sup>) and obese (≥25 kg/m<sup>2</sup>). Blood was withdrawn in aseptic condition and centrifuge at 3000 rpm for 10 mins. Separated serum was estimated insulin and leptin levels using elisa microplate reader, thermo scientific. Statistical analysis was performed using SPSS software version 20. All data were presented as mean ± standard deviation. Independent student t test was calculated to compare the different groups. In addition, the Pearson correlation coefficient (r) was used for correlation analysis. P<0.05 was considered significant.

### RESULTS

Out of 331 subjects, male and female were 119 and 212 respectively. Insulin and leptin levels showed significantly increased in obese than non-obese (p<0.01), as shown in Table 1. In comparison of female and male, insulin and leptin level were significantly higher in female among non-obese and obese groups (p<0.01) (Table 2). In Pearson correlations, no significant correlations were found between insulin and BMI whereas significant positive correlations was observed between leptin and BMI (p<0.01). In correlations of insulin and leptin, there was a significant positive correlation (p ≤ 0.01) (Table 3).

Table 1: Comparison of insulin and leptin between non-obese and obese.

Variables	Non obese (150)	Obese (181)	p- value
BMI (kg/m <sup>2</sup> )	21.78 ± 2.20	28.27 ± 3.22	0.01
Insulin (μIU/ml)	19.00 ± 18.86	37.42 ± 46.14	0
Leptin (ng/ml)	6.87 ± 6.53	12.97 ± 10.45	0

Significance at p<0.01

Table 2: Comparison of insulin and leptin between female and male within the groups.

Groups	Non obese			Obese		
	BMI (kg/m <sup>2</sup> )	Insulin (μIU/ml)	Leptin (ng/ml)	BMI (kg/m <sup>2</sup> )	Insulin (μIU/ml)	Leptin (ng/ml)
Female (212)	21.49 ± 2.30	17.61 ± 14.96	9.29 ± 7.07	28.69 ± 3.47	32.72 ± 37.27	16.35 ± 10.69
Male (119)	22.23 ± 1.99	21.10 ± 23.53	3.24 ± 3.15	27.57 ± 2.45	49.92 ± 60.93	6.25 ± 5.29
p-value	0.16	0	0	0.69	0	0

Significance at p<0.01

Table 3: Correlations of insulin, leptin with obese.

Variables	Correlation
Obese vs. Insulin	r=0.14
	p=0.59
Obese vs. Leptin	r=0.41**
	p=0.00
Leptin vs. Insulin	r=0.17*
	p=0.01

r=Pearson correlation, p=p-value, Significance at p ≤ 0.01\* and p<0.01\*\*

**DISCUSSION**

Leptin plays vital roles in number of different cell types as a mediator of energy expenditure and most actively in interaction with hormonal mediators, as a regulator of energy and metabolism such as glucagon, insulin, glucocorticoids and growth hormone [14]. Obesity is defined as the expansion of white adipose tissue (WAT) that can occur with adipogenesis or developed differentiation process of adipocyte cell as a precursor into adipocytes, but the mechanisms of this process are not yet fully reported. WAT regulates energy store and releases a range of factors with paracrine, autocrine and endocrine functions [15]. Insulin level is higher in obese than non-obese higher, but shows no correlation with obese in the present study. Similar data has also been reported by the previous study of Mohiti et al. [16].

Hyperleptinemia (HL) can play a causal role not just in developing obesity, but also in beta-cellular dysfunction prior to type 2 diabetes. Obesity leads to HL that further exacerbates HL by reducing hepatic insulin clearance [17]. Leptin levels were significantly increased in obese group and strongly correlates with obese in this study. Findings were supported with the study of Al Maskari et al. [18]. Leptin is significantly raised exponentially with adiposity, which implies endogenous leptin resistance in obesity [19]. Some researcher have claimed that in relation to the energy restriction, the most dramatic decrease in leptin levels was observed prior to any major changes in adipose tissue stores [20]. That observation implies that adiposity influence leptin levels and could be one of the major factors as positive correlations between leptinemia and insulin levels before and after adjustment for adiposity [21]. Our present study strongly supports the correlations of insulin and leptin in obese.

According to sexual dimorphism, fat accumulation and percentage of body fat is higher in females, tend to store more subcutaneous fat than males, whereas low percentage of body fat is present in males and visceral fat accumulation is more [22]. Females have higher insulin and leptin levels in obese than non-obese, as demonstrated in sexual dimorphism.

**CONCLUSION**

Our study shows that insulin and leptin levels are high in obese people compared to non-obese. Data showed sexually dimorphic that females are more susceptible to increase in insulin and leptin levels. There was a positive correlation between insulin and leptin metabolisms. With rising levels of insulin and leptin in obese subjects, the likelihood of prediabetic condition is high. Further studies on the dynamics of the relationship mechanisms between insulin, leptin and adipose tissue will be necessary to clarify the underlying importance in obesity and its complications of this Manipur population.

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**CONFLICTS OF INTEREST**

Authors declare that they have no conflicts of interest.

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