Obesity as A Risk Factor for Hypertension

Yahya Fahim

To Link this Article: http://dx.doi.org/10.6007/IJARPED/v10-i2/10680 DOI:10.6007/IJARPED/v10-i2/10680

Received: 07 May 2021, Revised: 11 June 2021, Accepted: 16 June 2021

Published Online: 22 July 2021

In-Text Citation: (Fahim, 2021)

Copyright: © 2021 The Author(s)
Published by Human Resource Management Academic Research Society (www.hrmars.com)
This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at: http://creativecommons.org/licenses/by/4.0/legalcode

Full Terms & Conditions of access and use can be found at
http://hrmars.com/index.php/pages/detail/publication-ethics
Obesity as A Risk Factor for Hypertension

Yahya Fahim
Assistant professor Department of Biochemistry, Faculty of Medical, Nangarhar University, Afghanistan
Email: fahim_icc@yahoo.com

Abstract
Obesity has been a global phenomenon around the globe, leading to a variety of disorders such as metabolic diseases, asthma, and cardiovascular disease. Obesity and overweight are often related to increased levels of aldosterone in the blood, which implies a direct relationship between obesity, high blood pressure and mineralocorticoid levels. Adipocyte is believed to have a part in the fight against homeostasis, and recent studies have now shown that human fat is a highly active endocrine tissue. The research thus examined whether adipocyte secretional products stimulate adrenocortical aldosterone secretion specifically. The steroid genesis in human adrenocortical cells, NCI-H295R and bovine adrenocortical cells, was increased by isolation of human adipocyte secretion products, focusing on the secretion of mineral corticoids. Finally, hypertension linked to obesity has the direct connection between the metabolism of fat tissue and the production of adrenal mineralocorticoids.

Keywords: Adrenal Cortex, Human, Bovine, Mineral Corticoid, Adipocyte, Hypertension.

Introduction
Obesity, especially visceral obesity, is closely linked to hypertension of the arteries. It was founded by a diversity of ethnic, religious and socioeconomic peoples and is not confined to the industrialized nations [see Ref. (1)]. Although it is long known that obesity is a cause of hypertension, the molecular basis of the relationship between obesity and high blood pressure still remains unclear.

Hyperaldosteronism is frequently linked to obesity (2–8), and plasma aldosterone levels are compared with fatty tissue volume (9). The aldosterone mineralocorticoid is the strongest adrenal cortex produced mineralocorticoid which helps salt buildup and blood pressure. A causal connection between high blood aldosterone levels and hypertension in obese individuals was therefore suggested (10). Surprisingly, the increase of aldosterone in obesity is frequently independent to the activity of the plasma renin (2,6,8). The same applies to our own results, in which the obese, normotensive (RR 130/80, n = 16) individuals were shown to have a somewhat higher aldosterone/renine ratio (RR>145/95, n = 16).

For a long time, white adipose tissue was only thought of as a source of lipids and thus an energy source. Adipose tissue has just lately been identified as a highly active endocrine organ and its involvement in body metabolism and homeostasis (11). We have investigated the assumption that human adipocyte secretory products are accountable for obesity-
relationship dysfunctions of suprarenal steroids, particularly an increased mineral corticoids secretion, by directly affecting adrenal cortical activity.

Materials and Methods

Human Tissues
The tissue specimens of human adipose are supplied from the stable women (20- to 35 years of age) who have undergone surgical mammal reductions (n = 10). As previously stated, collagenase digestion has been utilized to separate adipocytes (12,13). DMEM/F12 with 15 mmol/l HEPES and 2,5 mmol/l L-glutamine, 1.125 g/l NaHCO3, 100 U/ml penicillin, 100 mg/ml Streptomycin were cultivated in isolated, floating adipocyte serum free conditions. In a humidified environment of 5% CO2 cells were cultivated for 24 hours at 37°C. The conditioned media was collected attentively, preventing the lipid to float on top.

Adrenocortical Cells
The bovine adrenal in a local slaughterhouse was acquired in Nangarhar, Afghanistan and trypsin-digested adrenal cell was used for 3–4 days to cultivate a confluence of 70 percent in DMEM/F12 (14). NCI-H295R adrenocortical (ATCC) cells were grown using DMEM/F12 (12).

Incubation of Adrenocortical Cells
NCI-H295R or adrenocortical bovine cells have been cultured with 24 hours of fat, cell-conditioned media for serum-free conditions. For the incubation of adrenocortical bovine cells, FCCM was associated with ascorbic acid (20 mg/ml), bovine transferrin (10 mg/ml), bacitracin (100 mg/ml), penicilline (100 U/ml), streptomycin (100 mg/ml), and gentamycin (50 mg/ml). FCCM was supplemented by NCI-H295R cells, which included insulin (52 nM), hydrocortisone (10 nM), b-estradioxide (10 nM), transferrin (10 mg/ml), selenite (30 nM) and penicillin (1100 U/ml). After incubation and before analysis, the medium was collected and frozed at 20°C. Aldosterone concentration was measured using a direct radioimmunoassay in the incubation medium (Diagnostic Products Corporations, Los Angeles, CA).

Results and Discussion
According to our results, human adipocytes produce strong release factors. Fat cell-derived secretagogs induced adrenocortical steroidosis with the main impact on aldosterone release in human cells NCI-H295R. (Fig. 1).

Figure 1. Secretion of aldosterone (A) and cortisol (B) from NCI-H295R cells
This is recently confirmed in primary culture in bovine adrenocortical cells when fat-cell medial (FCCM) is compared with the maximum forskolin stimulation 210-5M (FSK). 24 h. n.d.: non-detectable cells were cultured. Mean ± SEM, n = four different preparations for fat cells, four
wells / experiment. Important differences in basal secretions are: p< 0.001 (**), p<0.01 (*).
[Ref. (12), D National Science Academy 2003].

**Figure 2.** Secretion of aldosterone (A) and cortisol (B) from bovine adrenocortical Primary culture cells after fat cell-conditioned media stimulation (FCCM). 24 h cells have been incubated. Mean ± SEM, n = 6 different tests, 4 wells/experiment. Important basal secretion differences are shown: p<0.001 (**), p<0.01 (*). FCCM incubation, albeit to a lower extent than in H295R cells, encouraged aldosterone and cortisol production (Fig. 2).
The adipose tissue produces angiotensinogen and angiotensin II in significant amounts. Fat-cell-conditioned medium stimulant activity (FCCM) also demonstrated an independent impact of an adipose angiotensin II in the presence of an Angiotensin type 1 receptor antagonist, valsartan. Factor-a may also be excluded from obesity, like lepin, adiponectin, interleukine-6, and tumor necrosis (12). The stimulating effect corresponded to the maximum stimulation of forskolin (2 10−5 M, Fig. 1). The activity was thermal, ammonium sulfate may be precipitated and protease digested, indicating the protein involved. Adipocytes also disclose at least two substances, which work together to boost aldosterone secretion (12).

**Figure 3.** Paraffin section of a human adrenal from a patient with intraadrenal myelolipoma. Adipocytes (A) in direct contact with adrenocortical cells (C) within the adrenal.

These results indicate that adipose tissue has an undiscovered direct involvement in the adrenocortics, particularly in the production of mineralocorticoids.
How do adipocyte secretion chemicals reach the adrenal cortex? Many adipocyte secretory products affect adipocyte metabolism via auto/paracrine.
However, many reasons are released and evaluated in the bloodstream (11,15). The adrenal and adrenocortical steroidosis produce an endocrine adrenal steroid in the circulation secretion from subcutaneous or visceral fat. In addition, in close contact with steroidal cells, fat cells are frequently present in the adrenal. Direct paracrine associations and potential steroidogenesis stimulation by adipocyte secretory products are made possible by this near cellular proximity. Our group recently published a case of an intraadrenal myelolipoma associated with ACTH-independent Cushing's syndrome (16), which included heavily intermingled myelolipomatous and adrenocortical tumor cells with plenty of clear cell–cell interaction (Fig. 3). Increased cortisol production in this patient is likely owing to the paracrine effects of myelolipoma cell secretion products.

We thus propose that mineralocorticotropic adipocyte factors may increase endocrine or paracrine aldosterone production and secretion leading to hyperaldosteronism and, as a consequence, obesity hypertension. This indicates that the fat cell mass and the blood pressure are clearly linked. Discovery of these reasons and subsequent characterization may lead to novel treatment options for hypertension associated with obesity.

References

