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The Effect of Sodium Level in Obesity with Blood Pressure and Compare with Obesity without Blood Pressure

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Abstract

Sodium ions (Na+) are essential for numerous homeostatic processes in the body, requiring precise regulation by different organ systems. Typically consumed through diet as sodium chloride (table salt), sodium imparts a salty flavor that is most palatable at concentrations supporting physiological balance. The regulation at a sodium balance is closely linked to sodium craving, a complex response that involves the brain, marginal tissue schemes, and endocrine signals, all working together to rise sodium consumption & restore levels when depleted. The brain plays a key role by interpreting visceral sensory information and hormonal cues to manage sodium consumption. Disruptions in these systems can lead to excessive sodium intake, which has been associated with the onset of conditions like hypertension in numerous studies.

This analysis shifts its focus to explore the opposite direction: how illnesses impact sodium intake, with particular attention Stress-related diseases and cardiometabolic diseases. Some people think that these diseases, cause increased sodium consumption, potentially creating a cycle that worsens the condition. Initially, the mechanisms governing each of these processes independently are discussed. Following this, the overlapping areas between these processes are examined. It's suggested that the neural circuits responsible for both sodium intake and blood pressure regulation might explain The interrelationships between these regulatory functions. Finally, the discussion explores how cardiometabolic and stress-related illnesses impact these circuits, altering sodium consumption patterns. [1].

Keywords: Sodium, aldosterone, blood pressure, interconnected factors, particularly, obesity-related hypertension.

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Overview

Elevated blood pressure is linked to a higher risk of circulatory challenges, irrespective of the antihypertensive medications arranged. Lowering blood pressure by any amount has shown to reduce vascular events by 10% for each 5 mmHg decrease in systolic BP. Beyond approaches that involve identifying patients with untreated hypertension and initiating antihypertensive treatments, it is essential to reduce BP to recommended levels to decrease circulatory risk and improve management of hypertension. In Korea, less than half of individuals with hypertension have their condition well-regulated, and approximately 70% of those receiving treatment manage to maintain control over their condition.[3] Patients with resistant hypertension face considerable challenges due to the complexities involved with their summary answer to different antihypertensive agents, medical symptoms, detailed causes, prediction, & organization strategies. Sympathetic the underlying causes & patho physiology of hyper tension that remains difficult to manage despite treatment with multiple medications is crucial for improving blood pressure control rates, which have seen little progress over time. [4].

The link between obesity and hypertension poses a serious challenge to public health. An increased activity of the sympathetic nervous system (SNS), especially within fat tissue, is crucial in connecting these two conditions. Certain adipokines play a significant role in raising blood pressure. Hyperinsulinemia, resulting from insulin resistance, leads to sodium reabsorption and retention, increasing plasma volume circulation. It also activates the renin-angiotensin-aldosterone system (RAAS) and the SNS, which can accelerate atherosclerosis by causing hypertrophy of vascular plane influence cells, thereby enhancing peripheral a vascular resistance. Although there is often fluid overload, obesity still increases RAAS activity due to stimulation of tissue RAAS in those with obesity-related hypertension. Furthermore, mineralocorticoid receptor-related hypertension should be considered in sick with resistant High blood pressure linked to fat. The obstreperous slumber apnea syndrome (OSAS) is widely recognized as a leading cause of secondary hypertension. Gut microbiota mechanisms are influential in blood pressure regulation, so obesity-induced gut dysbiosis may contribute to higher blood pressure levels. Japanese individuals tend to have a higher ratio of visceral fat to subcutaneous fat compared to Caucasians, possibly explaining their greater susceptibility to metabolic disorders despite being Less fat than Caucasian persons. The kidney dysfunction that accompanies obesity straight raises blood pressure, worsening kidney damage further. Losing more than 3% of body weight or over 5 kilograms can significantly lower blood pressure. Gastric avoid operation is an actual treatment for severe fatness and its connected metabolic conditions, counting high blood pressure. As together fat and high blood pressure are largely routine-connected issues, routine changes that focus on tackling obesity should take precedence in managing hypertension..[5]

Body Mass Index:

The form bulk index (BMI) helps as an analytical instrument to evaluate bulk heaviness in relative to height across diverse populations. For the majority of individuals, excluding those engaged in rigorous physical activity or resistance training—such as bodybuilders—BMI is a reliable indicator of body fat percentage. However, this correlation is not uniform across all demographics; it is affected by variables such as gender, age, and ethnicity. Notably, research indicates that South Asian populations tend to exhibit a higher body fat percentage at equivalent BMI values. In the (US), the second National Health and Nutrition Examination Survey (NHANES II) established obesity benchmarks for adults, defining fat as a BMI of 27.3 kg/m² or above for female and 27.8 kg/m² or over for male, based on the 85th percentile for persons aged 20 to 29.

In 1998, the Expert Panel from the National Institutes of Health (NIH) on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults endorsed the World Health Organization (WHO) benchmarks for overweight and obesity classification. The WHO framework, originally designed with

individuals of European descent in mind, associates heightened risks of conditions such as high blood pressure, type 2 diabetes mellitus, and cardiovascular ailments with elevated BMI metrics comparative to a normal range of 18.5 to 25 kg/m². Asian populations face increased susceptibility to diabetes and high blood pressure at comparatively lesser BMI levels than non-Asian groups, primarily due to central fat distribution patterns. In response, the WHO has proposed reduced BMI thresholds for therapeutic intervention in Asians: a bmi of 18.5 - 23 kg/m² signifies an suitable danger level, 23 - 27.5 kg/m² indicates increased danger, & a bmi exceeding 27.5 kg/m² denotes great danger. [2]

Table 1. Classification of Overweight and fat by bmi, Waist Circumference, and Associated Disease Risk

	BMI (Kg/m^2)	Osesity class	Disease risk * (relative normal weight and waist circumference)	
			Men ≤40 inches (≤102 cm) women ≤35 inches (≤88 cm)	>40 in (>102 cm)>35 in (>88 cm)
Underweight	<18.5		-	-
Normal	18.5 -24.9		-	-
Overweight	25.0-29.9	I	Increased	High
Obesity	30.0-34.9 35.0-39.9	II	High Very high	Very high Very high
Extreme obesity	≥40	III	Extremely high	Extremely high

*Sickness danger for type 2 diabetes, high blood pressure, and cardiovascular sickness.

†rise waist circumference can also be a marker for rise risk even in persons of normal weight.

High blood pressure description classification:

Diastolic blood pressure (DBP) is clinically defined as a measurement of 90 mm Hg or above, recorded across several examinations. The classifications of blood pressure based on clinical measurements are detailed in Table 2, while Table 3 categorizes ambulatory and home blood pressure readings which are used to diagnose hypertension. These classifications apply universally to adults aged over 18 years. The categorization system is intended to align targeted therapeutic approaches with specific blood pressure levels.

The classification of high-normal blood pressure aims to identify individuals who might benefit from lifestyle changes and, if validated by evidence, may require pharmacological intervention. Isolated systolic hypertension, distinguished by an elevated systolic blood pressure (systolic bp ≥140 mm Hg) with a little diastolic bp (<90 mm Hg), is prevalent in both younger and older demographics. In early persons, counting kids, youths, and young grownups, it represents the utmost common formula of essential high blood pressure. Among the aging, this condition is repeatedly indicative of arterial stiffness & is associated with an rise pulse tension, which is the variance between systolic bp & distolic..[2]

- Individuals diagnosed with high blood pressure, classified as grade 1 or grade 2, should receive suitable pharmacological interventions..[2]

Table 2. Organization of high blood pressure Constructed on Workplace Blood Pressure (BP) Measurement.

Category	Systolic (mm Hg)		Diastolic (mm Hg)
Normal BP	<130	and	<85
High-normal BP	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	≥160	and/or	≥100

Table 3. Criteria for Hypertension Based on Office-, Ambulatory (ABPM)-, and Home Blood Pressure (HBPM) Measurement.

	SBP/DBP, mm Hg
Office BP	≥140 and/or ≥90
ABPM	
24-h average	≥130 and/or ≥80
Day time (or awake) average	≥135 and/or ≥85
Night time (or asleep) average	≥120 and/or ≥70
HBPM	≥135 and/or ≥85

Method:

A case-control study was conducted between April 2023 and May 2023, involving a total of 90 participants, both female and male. The subjects were divided into three distinct groups:

Group I: This group comprised 30 healthy individuals who were neither obese nor hypertensive, all above the age of 18.

Group II: This group consisted of 30 individuals who were both obese and hypertensive, with no current treatment, all above the age of 18.

Group III: This group included 30 obese individuals without hypertension, who were also not undergoing treatment, all above the age of 18.

Elimination Criteria :

The following exclusion criteria were established:

1. Patients diagnosed with adrenal tumors or cancer.
2. Any patients with any form of tumor or cancer.
3. Patients who have undergone cardiac surgery.
4. Individuals experiencing chronic illnesses.

Enclosure criteria:

1. Individuals identified with hyper blood pressure.
2. They do not take any medication for hyper blood pressure.
3. They do not have kidney or heart sickness.
4. Fat with a BMI above 30 kg/m².

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Waist circumference was leisurely at each of the subsequent sites:

1. The average between the bony landmarks of the ribs and the superior iliac crest (method A).
2. The level of the cross crease that seems when a person leans to one side (method B).
3. 4 cm above the navel (method C).[4]

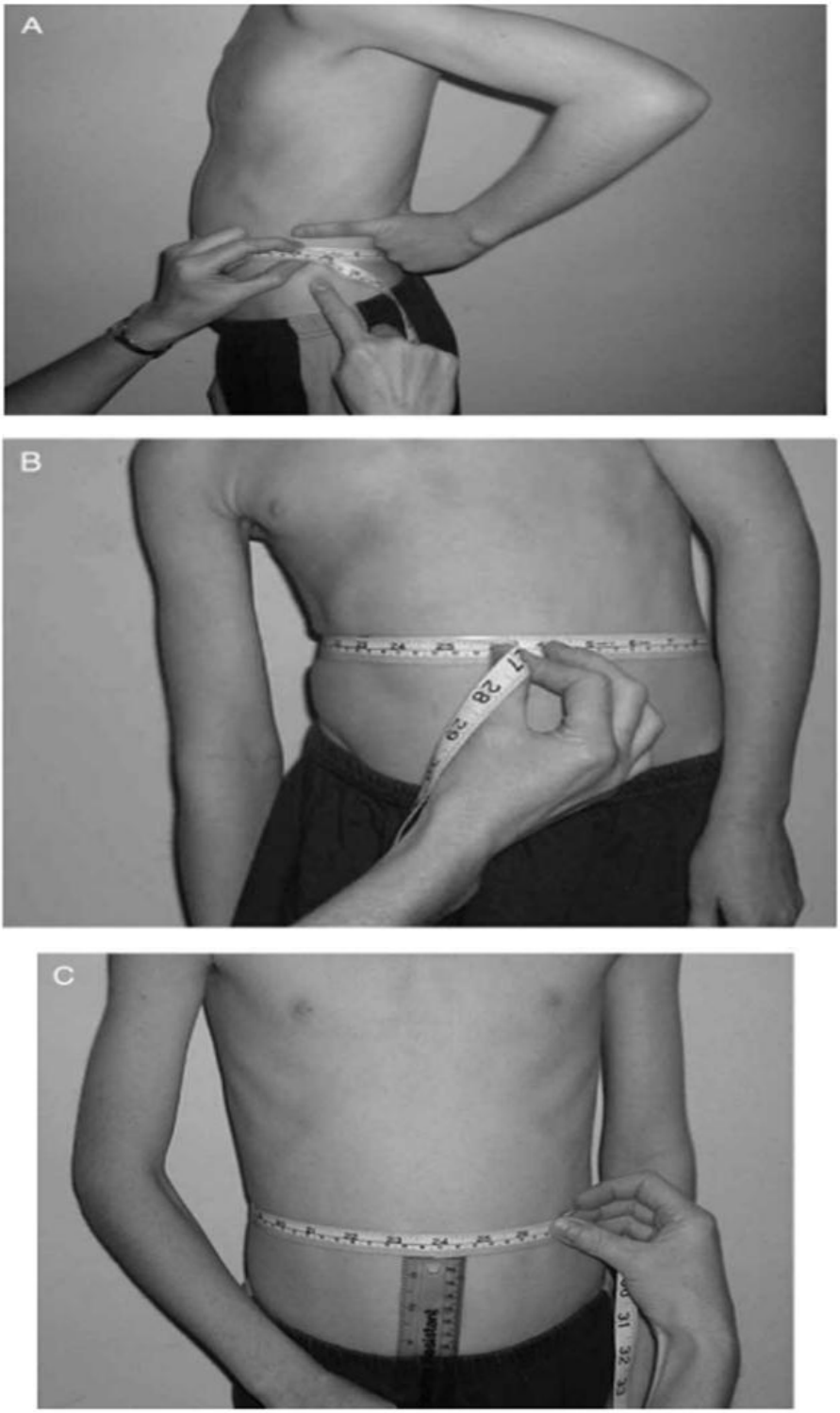


Figure 1. The recommended approaches for measuring children's waistlines currently include: A) the midpoint between the lowest rib and the iliac crest, B) the crease on lateral flexion, and C) 4 cm above the umbilicus.

Waist circumference measurement:

When the participant stood up, a skilled examiner located the belly button and gently wrapped a soft measuring tape around the waist at the height of the navel. The participant was then guided to breathe normally and pause their breath following an exhalation. The waist circumference was recorded once the participant completed a customary breath out. Further instructions for measuring waist circumference can be found in the CHARLS Biomarker Questionnaire Protocol on their website. [2].

Hypertension definition:

After a 30-minute rest while sitting, the cuff was placed about half an inch above the elbow. Blood pressure readings, covering both systolic and diastolic values, were taken three times by a trained examiner using an Omron HEM-7200 automatic blood pressure monitor. The average of these measurements was then determined. In this study, individuals were confidential as having high tension if they met any of the subsequent criteria: an middling systolic b p of 140 mmHg or advanced, a diastolic bp of 90 mmHg or advanced, self-reported high tension , or current use of antihypertensive medications. [1].

Body Mass Index (BMI)

Body mass index (BMI) was calculated by measuring weight in kilograms and height in meters using appropriate scales, and then applying the following equation:-

BMI (Kg/m2) = Weight / Height 2

Statical analysis:

Continuous variables are expressed as mean ± standard deviation. To compare clinical parameters across various BMI categories, an analysis of variance (ANOVA) test was employed for continuous variables. Following this, a post hoc least significant difference (LSD) test was conducted for multiple group comparisons. The threshold for numerical connotation was recognized at a P-value of 0.05.

Results:

Table 1: show descriptive of variables.

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
AGE(YEAR)	90	53	14	67	34.70	10.184	103.718
GENDER	90	1	1	2	1.58	.497	.247
BMI(Kg/m^2)	90	35.18	19.11	54.29	32.8116	6.47683	41.949
SYSTOLIC B.P.	90	100	100	200	124.33	21.983	483.258
DYSTOLIC B.P	90	60	60	120	80.91	16.810	282.576
BP(mmHg)	90	1.00	1.00	2.00	1.3333	.47405	.225
waist (cm)	90	92	71	163	106.28	16.063	258.023
potassium(mmol/l)	90	246.16	.84	247.00	6.5794	25.64355	657.592
Sodium(mmol/l)	90	175.37	72.13	247.50	154.8752	42.90717	1841.025
obesity	90	2	1	3	2.00	.821	.674
Valid N (listwise)	90						

Table 2: show compare between potassium level and BMI ,systolic pressure ,diastolic pressure.

ANOVA								
				Amount of Squares	df	Malicious Square	F	Sig.
BMI(Kg/m^2)	Between Groups	(Combined)		1845.325	44	41.939	1.000	.500
		Linear Term	Weighted	53.299	1	53.299	1.270	.266
			Deviation	1792.027	43	41.675	.993	.508
	Within Groups			1888.168	45	41.959		
	Total			3733.493	89			
SYSTOLIC B.P.	Between Groups	(Combined)		17924.583	44	407.377	.731	.850
		Linear Term	Weighted	5.809	1	5.809	.010	.919
			Deviation	17918.774	43	416.716	.748	.830
	Within Groups			25085.417	45	557.454		
	Total			43010.000	89			
DYSTOLIC B.P	Between Groups	(Combined)		12916.900	44	293.566	1.080	.399
		Linear Term	Weighted	.702	1	.702	.003	.960
			Deviation	12916.198	43	300.377	1.105	.370
	Within Groups			12232.389	45	271.831		
	Total			25149.289	89			

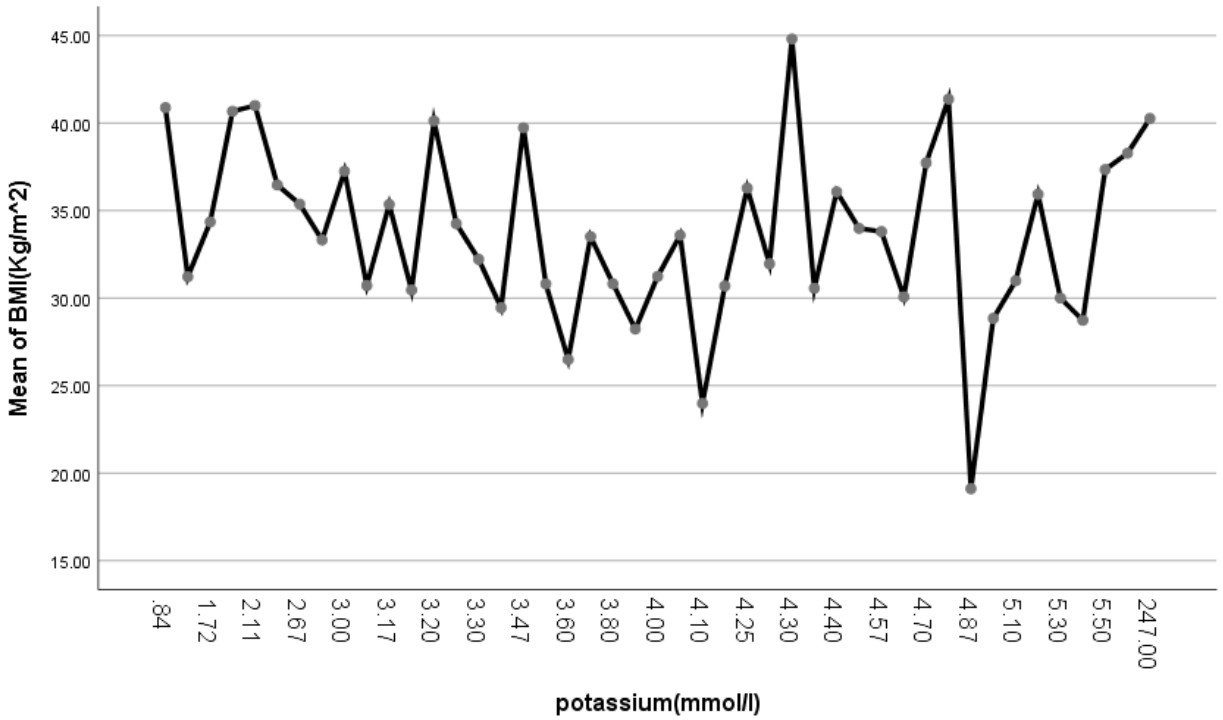


Figure 1: show potassium comparession with systolic B. pressue .

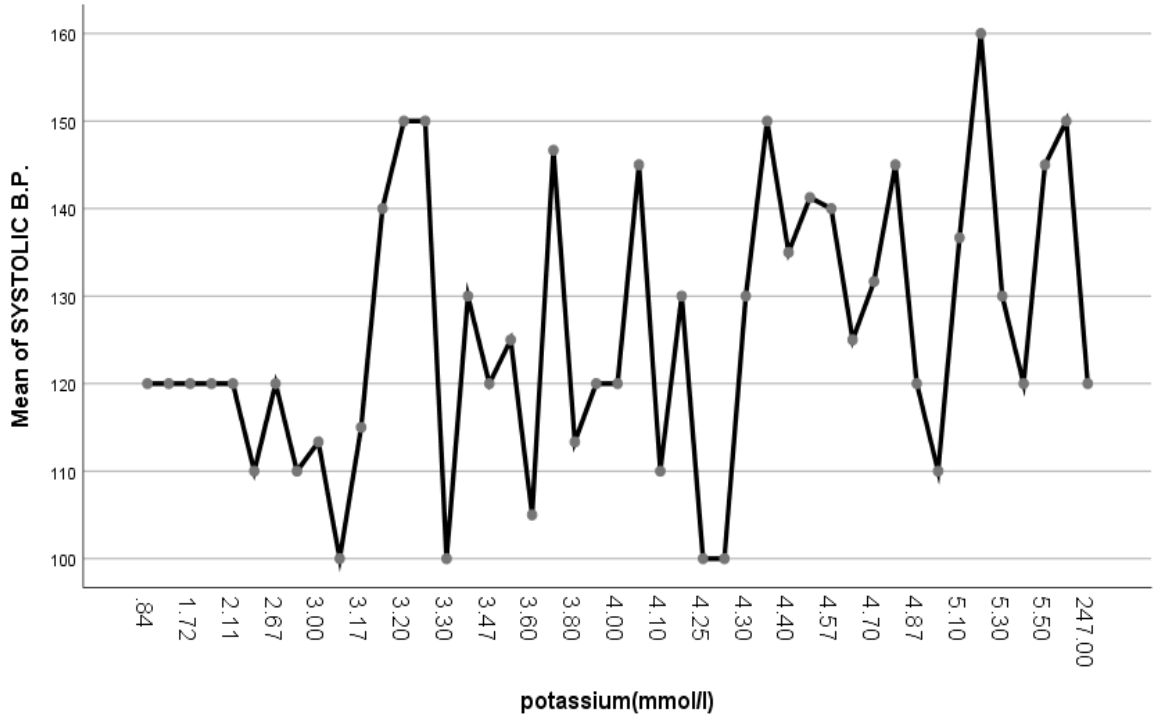


Figure 2: show comparssion between potassium and systolic B.pressure.

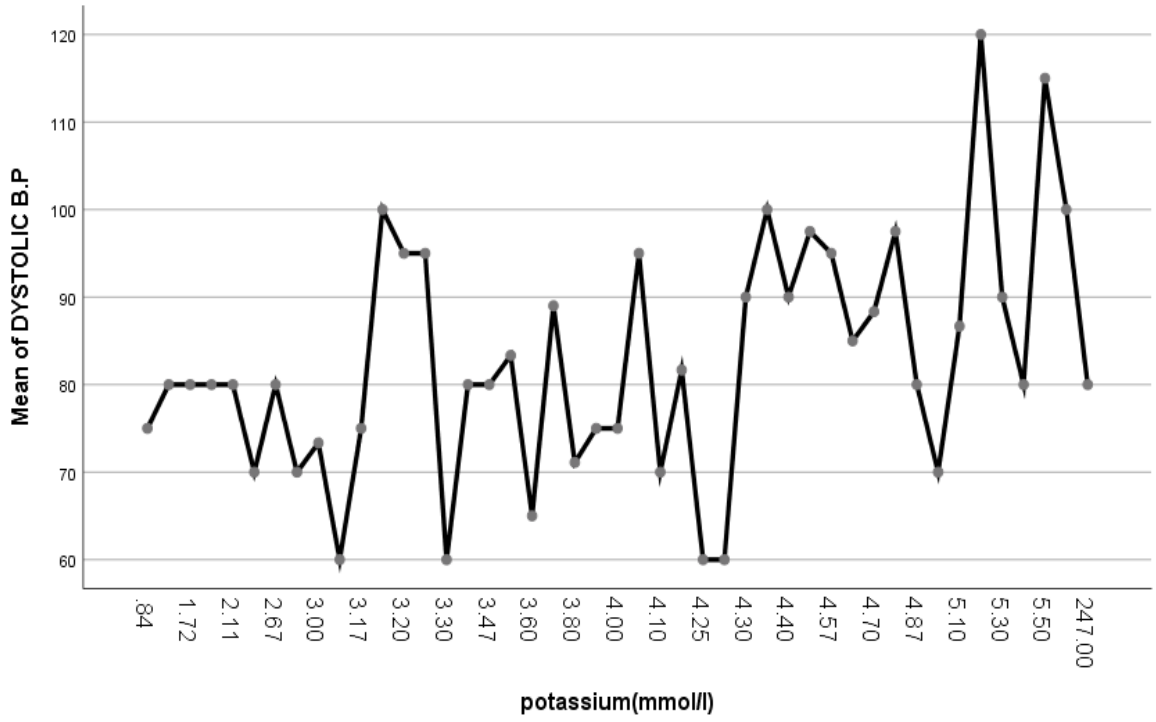


Figure 3: show comparssion between potassium and dystolic B. pressure.

Table 3: show comparssion between sodium and variables (BMI, systolic B.pressure, dystolic B. pressure).

ANOVA								
				Sum of Squares	df	Mean Square	F	Sig.
BMI(Kg/m^2)	Between Groups	(Combined)		3298.446	74	44.574	1.537	.177
		Linear Term	Weighted	384.193	1	384.193	13.247	.002
			Deviation	2914.253	73	39.921	1.376	.250
	Within Groups			435.047	15	29.003		
	Total			3733.493	89			
SYSTOLIC B.P.	Between Groups	(Combined)		38243.333	74	516.802	1.626	.146
		Linear Term	Weighted	2657.600	1	2657.600	8.363	.011
			Deviation	35585.734	73	487.476	1.534	.178
	Within Groups			4766.667	15	317.778		
	Total			43010.000	89			
DYSTOLIC B.P	Between Groups	(Combined)		22170.122	74	299.596	1.508	.188
		Linear Term	Weighted	1945.299	1	1945.299	9.795	.007
			Deviation	20224.823	73	277.052	1.395	.240
	Within Groups			2979.167	15	198.611		
	Total			25149.289	89			

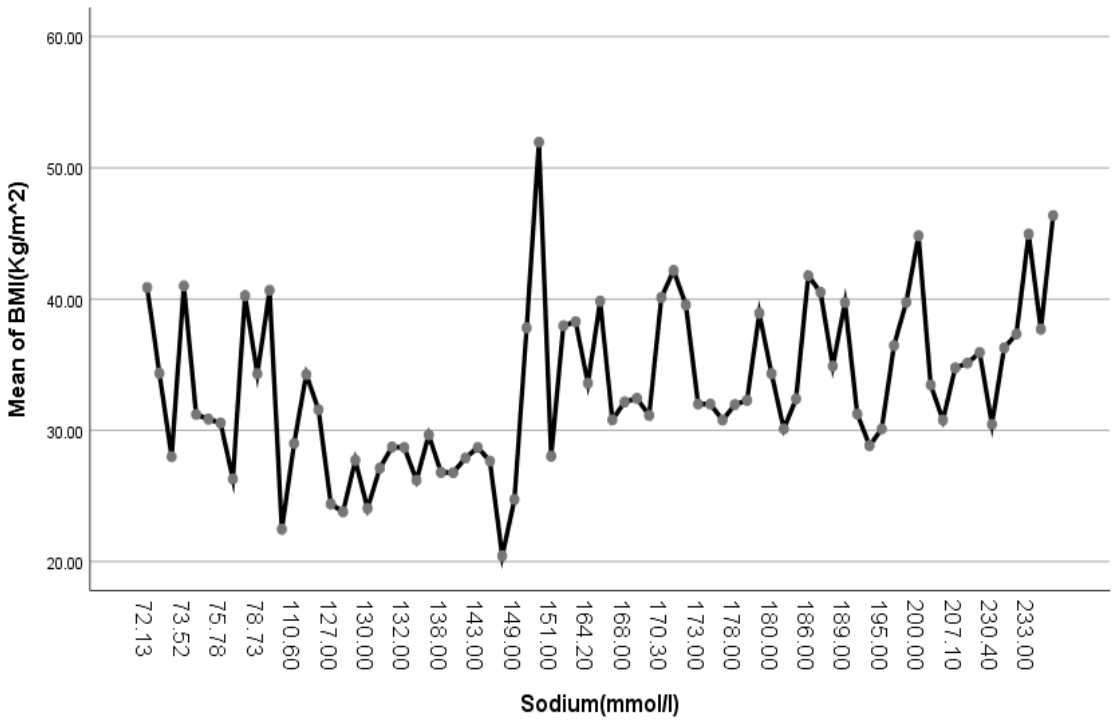


Figure 4: show comparssion between sodium and BMI.

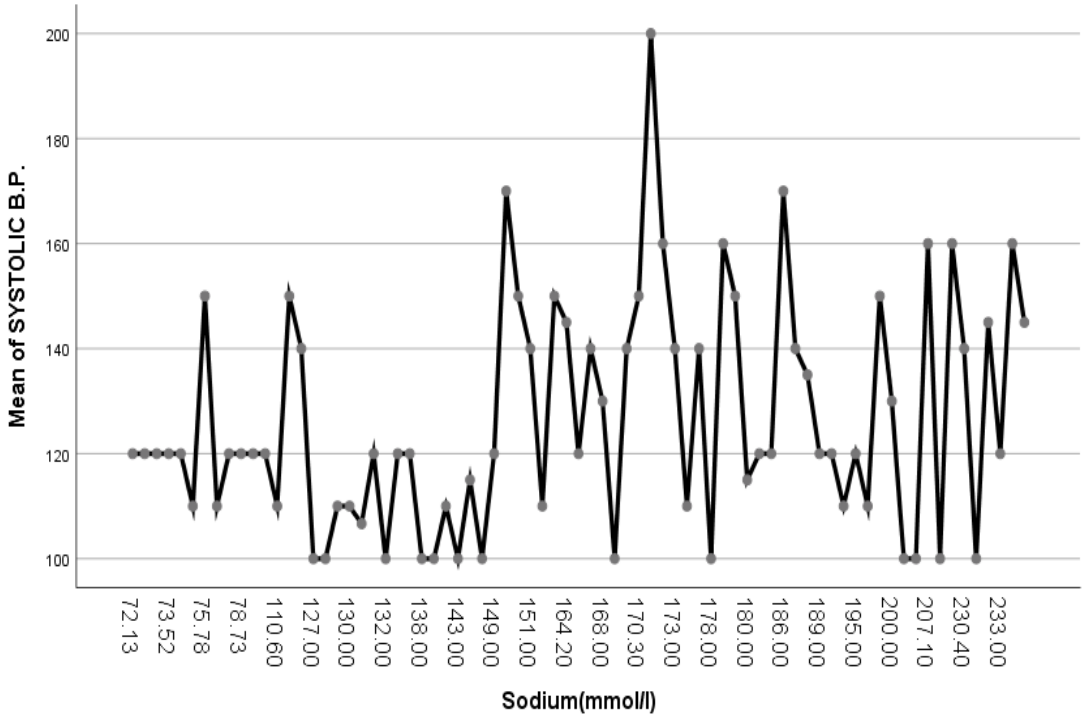


Figure 5: show comparssion between sodium and systolic B.pressure.

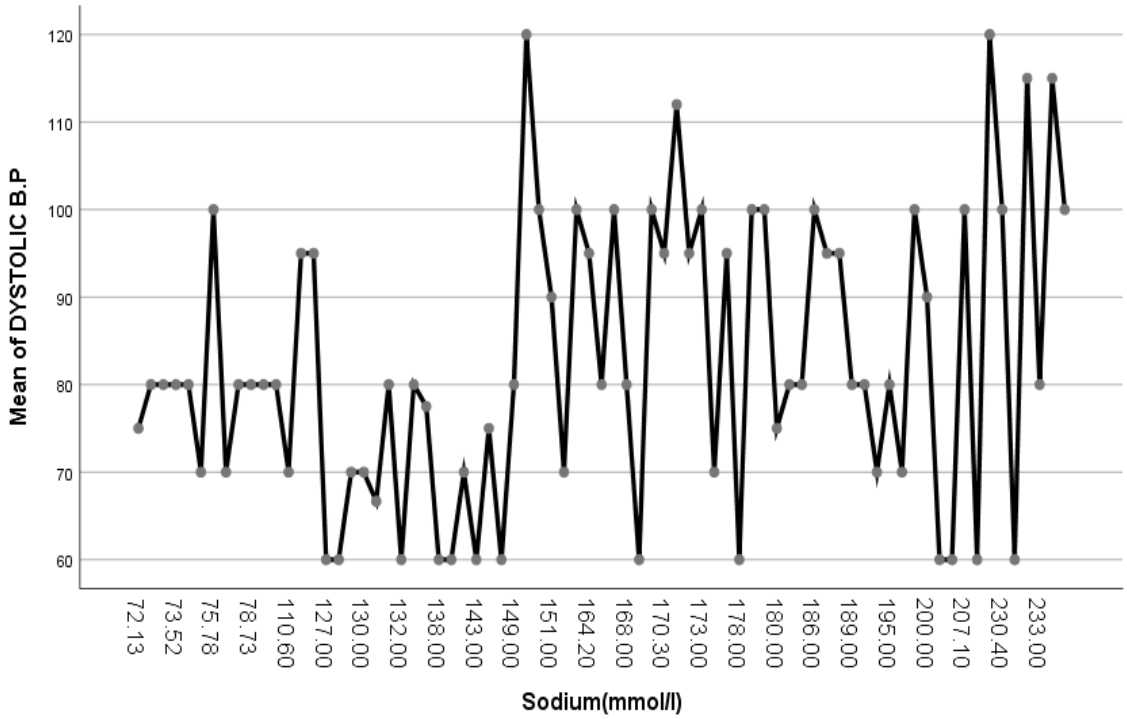


Figure 6: show comparssion between sodium and dystolic B.pressure .

Dissuasion:

The findings suggest that elevated sodium levels contribute to an increase in both diastolic and systolic blood pressure by stimulating the renin-angiotensin system. This rise in sodium concentration is likely due to retention. Conversely, potassium levels usually decrease as systolic and diastolic blood pressure climb, and they are also reduced with higher BMI and waist circumference, which are linked to increased excretion and pathway interference caused by high pressure. In healthy individuals without problems

related to weight gain or high blood pressure, sodium and potassium levels typically remain stable. In obese patients with high blood pressure, sodium levels increase because of greater sodium reabsorption and increased potassium excretion, unlike obese individuals who do not have high blood pressure despite their weight. Nonetheless, the sodium increase is relatively slight, and when compared to healthy individuals, the levels remain moderate.

Conclusion:

The findings indicate that rising sodium levels stem from an increased concentration. It has been noted that sodium levels are affected by obesity, whereas blood pressure has only a modest impact. High blood pressure might be linked more closely to other clinical conditions.

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