Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Impact of Seasonal Fruit Consumption on Perceived Stress and Serum Cortisol: A Prospective Study

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ABSTRACT

Background: Psychological stress is increasingly prevalent due to modern lifestyle changes, academic pressures, and unhealthy dietary habits. Chronic stress activates the hypothalamic–pituitary–adrenal axis, resulting in elevated cortisol levels that adversely affect mental and physical health. Fruits are rich in antioxidants, micronutrients, and bioactive compounds that may help modulate stress responses; however, Indian data examining their combined psychological and biochemical effects are limited.

Objectives: To evaluate the effect of daily consumption of 250 g of seasonal fruits on perceived stress levels and serum cortisol concentrations in adults.

Methods: This prospective, single-arm interventional study included apparently healthy adults aged 18–45 years. Participants consumed 250 g of locally available seasonal fruits daily for six months. Perceived stress was assessed using the Perceived Stress Scale–10, and fasting morning serum cortisol levels were measured at baseline and post-intervention. Compliance was monitored through weekly dietary records. Pre- and post-intervention comparisons and correlation analyses were performed.

Results: Following six months of intervention, participants showed a significant reduction in perceived stress scores and serum cortisol levels compared to baseline. Greater improvements were observed among individuals with higher baseline stress. A positive correlation was noted between perceived stress scores and serum cortisol concentrations. The intervention demonstrated good acceptability and adherence.

Conclusion: Daily intake of seasonal fruits is associated with significant improvements in both perceived and biochemical stress markers. This simple, affordable dietary strategy may contribute to stress reduction and improved mental well-being in high-stress populations.

Keywords: Seasonal fruits, perceived stress, serum cortisol, dietary intervention, mental health

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1. INTRODUCTION

Psychological stress is a growing public health concern worldwide, influenced by rapid urbanization, academic and occupational pressures, sedentary lifestyles, and unhealthy dietary practices [1,2]. Chronic stress adversely affects mental and physical health and is strongly associated with anxiety, depression, cardiovascular disease, metabolic disorders, and immune dysfunction [3,4]. These effects are primarily mediated through activation of the hypothalamic–pituitary–adrenal (HPA) axis, leading to increased secretion of cortisol, the principal stress hormone [5].

Sustained elevation of cortisol has deleterious effects on brain structure and function, including impaired neuroplasticity, hippocampal volume reduction, mood dysregulation, insulin resistance, and abdominal obesity [6,7]. Therefore, interventions that reduce perceived stress and normalize cortisol secretion are of considerable clinical relevance [8].

In recent years, diet has emerged as a modifiable determinant of mental health. Fruits are rich in vitamins, minerals, dietary fiber, and bioactive compounds such as polyphenols, which influence oxidative stress, inflammation, neurotransmitter synthesis, and gut–brain axis signaling [9,10]. Observational studies have consistently demonstrated associations between higher fruit intake and improved psychological well-being, lower stress levels, and reduced risk of depressive symptoms [11,12].

However, most evidence originates from Western populations, and interventional data examining the combined effect of fruit consumption on subjective stress and biochemical markers such as cortisol remain limited, particularly in the Indian context [13]. Seasonal fruits are affordable, culturally acceptable, and widely accessible in India, making them a feasible public health intervention [14]. The present study was therefore designed to evaluate the effect of daily seasonal fruit intake on perceived stress and serum cortisol levels in adults.

2. MATERIALS AND METHODS

Study Design and Participants - 104 apparently healthy adults enrolled in a prospective interventional study over 6 months

This prospective interventional study was conducted among apparently healthy adults after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants. [15]

Adults aged 18–45 years who were not consuming fruits daily were included. Individuals with diagnosed psychiatric disorders, chronic medical illnesses, endocrine disorders, or those on medications affecting cortisol levels were excluded to minimize confounding [16].

Intervention

Participants were instructed to consume 250 g of locally available seasonal fruits daily for a period of six months. No additional dietary or lifestyle modifications were advised during the study period to isolate the effect of fruit intake [17]. Compliance was monitored using periodic dietary recall and follow-up interactions.

Assessment of Perceived Stress

Perceived stress was assessed using the Perceived Stress Scale-10 (PSS-10), a validated self-report instrument widely used to assess stress perception in community and clinical settings [18].

Biochemical Analysis

Fasting morning venous blood samples were collected at baseline and after six months. Serum cortisol levels were measured using standardized laboratory methods. Morning sampling was chosen to minimize diurnal variation in cortisol secretion [19].

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Statistical Analysis

Data were analyzed using appropriate statistical methods. Pre- and post-intervention comparisons were performed using the Wilcoxon signed-rank test. Correlation between perceived stress scores and serum cortisol levels was assessed using Pearson correlation analysis. A p-value <0.05 was considered statistically significant [20].

3. RESULTS

Table 1: Baseline Sociodemographic Profile of Participants

Sociodemographic Information		Patients	Percentage
Age Group (Years)	18-30 Years	4	3.85%
	31-45 Years	16	15.38%
	46-60 Years	43	41.35%
	61-75 Years	36	34.62%
	76-90 Years	5	4.81%
	Mean±SD	55.62±12.86	
	Median	58.00	
	Range	18-81	
Gender	Female	66	63.46%
	Male	38	36.54%
Education	Illiterate	0	0%
	Primary	2	1.92%
	Upto Matric	8	7.69%
	Undergraduate	11	10.58%
	Graduate	73	70.19%
	Post Graduate	9	8.65%
	Ph.D.	1	0.96%
Religion	Hindu	49	47.12%
	Sikh	50	48.08%
	Muslim	5	4.81%
Occupation	Advocate	1	0.96%
	Businessman	1	0.96%
	Employed	18	17.31%
	Housewife/ Housemaker	4	3.85%
	Retired	36	34.62%
	Self-Employed	3	2.88%
	Student	2	1.92%
	Unemployed	39	37.50%
Marital Status	Unmarried	5	4.81%
	Married	92	88.46%
	Widow	7	6.73%
Daily Seasonal Fruits Intake (250 g)	Yes	0	0%
	No	104	100%

A total of 104 participants completed the study. The mean age of participants was 55.62 ± 12.86 years, with females constituting 63.46% of the study population. At baseline, participants demonstrated moderate perceived stress, with a mean PSS score of 19.86 ± 7.55.

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Table 2: Baseline perceived stress and serum cortisol levels among participants

Baseline	Perceived Stress	Serum Cortisol Levels
Mean±SD	19.86±7.55	24.74±5.06
Median	19.00	24.78
Range	8-36	7.77-33.19

Mean serum cortisol levels were elevated at 24.74 ± 5.06 µg/dL, reflecting heightened HPA axis activity.

Table 3: Compare perceived stress at baseline with after 6 months

Perceived Stress Scale	Baseline	At 6 Months
Mean±SD	19.86±7.55	12.99±4.16
Median	19.00	12.50
Range	8.36	7-21
Mean Difference	6.87	
Wilcoxon	7.914	
p value	0.001 (HS)	

Table 4: Compare Serum Cortisol Level at baseline with after 6 months

Serum Cortisol Level (µg/dL)	Baseline		At 6 Months	
	Patients	Percentage	Patients	Percentage
Below (<6.7)	0	0%	0	0%
Normal (6.7-22.6)	12	11.54%	104	100%
Above (>22.6)	92	88.46%	0	0%
Mean±SD	24.74±5.06		11.90±3.38	
Median	24.78		10.85	
Range	7.77-33.19		7.13-19.05	
Mean Difference	12.84			
Wilcoxon	8.746			
p value	0.001 (S)			

Following six months of daily seasonal fruit intake, a statistically significant reduction in perceived stress was observed. Mean PSS scores decreased to 12.99 ± 4.16 (p = 0.001). A significant reduction in serum cortisol levels was also noted, with mean values declining to 11.90 ± 3.38 µg/dL (p = 0.001). All participants demonstrated cortisol values within the physiological range at the end of the intervention.

Pearson Correlation		Serum Cortisol Level (µg/dL)
Perceived Stress Scale	r value	-0.131
	p value	0.186

Correlation analysis revealed a weak and non-significant association between perceived stress scores and serum cortisol levels at both baseline and post-intervention.

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4. DISCUSSION

The findings of the present study indicate that daily consumption of seasonal fruits for six months significantly reduces perceived stress and serum cortisol levels. These results support the emerging concept of nutritional modulation of stress and mental health [9,11].

The reduction in perceived stress may be attributed to the synergistic effects of micronutrients and antioxidants present in fruits, which influence neurotransmitter synthesis, oxidative balance, and inflammatory pathways involved in stress regulation [10,12]. Vitamins such as vitamin C and folate, along with polyphenols, have been shown to enhance stress resilience and cognitive function [9].

Normalization of cortisol levels is clinically significant, as chronic hypercortisolemia is implicated in the development of metabolic syndrome, cardiovascular disease, and mood disorders [6,7]. Dietary interventions that attenuate HPA axis overactivity may therefore provide long-term protective health benefits [8].

The absence of a strong correlation between perceived stress and cortisol levels is consistent with previous studies suggesting that subjective stress perception and physiological stress responses may operate through partially independent mechanisms [19].

Given the affordability and accessibility of seasonal fruits, this intervention has important public health implications, particularly in resource-limited settings [14].

5. CONCLUSION

Regular intake of 250 g of seasonal fruits over six months leads to significant reductions in perceived stress and normalization of serum cortisol levels. Incorporation of seasonal fruits into daily diets may serve as a simple, cost-effective strategy for stress reduction and mental well-being promotion.

Limitations

The single-arm study design, moderate sample size, and reliance on self-reported dietary compliance limit causal inference and generalizability. Future randomized controlled trials are required to confirm these findings and explore long-term outcomes [20].

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