

The effect of instant pumpkin-base soups on the nutritional status, blood pressure, and constipation status in the elderly

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Abstract. This study evaluated the effects of two types of instant pumpkin soup on nutritional status, blood pressure, and constipation in the elderly. A total of 18 healthy elderly participants were involved in this quasi-experimental study, divided into two groups: one receiving instant pumpkin soup supplemented with chicken breast (IPB) (n = 9) and the other consuming the original recipe instant pumpkin soup (IPO) (n = 9). The participants were provided with 15 grams of soup for 4 weeks, with a frequency of 6 days per week. Body mass index (BMI), blood pressure, and constipation status were assessed at both the beginning and end of the intervention. The results indicated a significant decrease in both systolic and diastolic blood pressure in the IPB group, while the IPO group showed a non-significant reduction. Both groups experienced shorter defecation durations and an increase in Bristol stool scores following the intervention. Additionally, both soups helped maintain the BMI of the participants. This study concludes that modifying instant pumpkin soup by adding chicken breast can provide more beneficial effects, particularly in regulating blood pressure.

1 Introduction

The elderly are one of the most vulnerable groups at risk of malnutrition. The population of elderly individuals continues to rise in Indonesia, with the national percentage reaching 11.75% in 2020—an increase of nearly 2% compared to 2010 [1]. However, the proportion of healthy elderly individuals in Indonesia is relatively low, accounting for less than one-third of the total elderly population. This vulnerable condition is often associated with an increased risk of non-communicable diseases (NCDs), including heart disease, stroke,

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diabetes, and cancer [2]. Hypertension, frequently observed in the elderly, is a significant risk factor for NCDs, with its prevalence among this demographic potentially reaching 65%. Furthermore, constipation is a common issue among the elderly, with meta-analysis results indicating a global prevalence of 18.9% [3].

Numerous studies have reported that the elderly often fail to meet their nutritional needs. Adequate nutrition is crucial for maintaining health and preventing disease among the elderly. Factors such as declining oromotor function—manifested as difficulty chewing due to missing teeth, decreased sensitivity in taste, and impaired function of the digestive system—contribute to inadequate nutrient intake in this population [4]. Moreover, insufficient intake of essential nutrients, particularly antioxidants and fiber, can elevate the risk of developing NCDs [5]. Unfortunately, there remains a limited food specifically designed to address the nutritional needs of the elderly.

Pumpkin is widely cultivated in Indonesia and is often utilized in the development of functional food products. It possesses a favorable nutritional profile, being rich in β -carotene, phenolic compounds, flavonoids, vitamins, and minerals while having low caloric content [6]. Previous research has developed an instant pumpkin cream soup, primarily focusing on its acceptability among the elderly was the primary focus [7]. The developed instant pumpkin soup exhibited α -glucosidase inhibition activity at a concentration of 5 μ g (94%), provided 46.9% of the daily β -carotene requirement, and contained chromium at 73.2 μ g/100 g. Despite a high acceptance rate and potential beneficial effects, the soup's protein content was found to be low (2.2%) [8]. To enhance the nutritional content of this instant pumpkin soup, particularly its protein content, this study incorporated chicken breast into the formulation. Chicken breast is a widely used protein source (20.46–22.37%) that enhances amino acid intake and is also a source of branched-chain amino acids (BCAAs), which are vital for maintaining muscle mass. Thus, this study aimed to compare the effects of reformulated instant pumpkin soup with chicken breast against the original recipe on nutrient intake, nutritional status, blood pressure, and constipation scores among the elderly.

2 Methods

2.1 Design and subjects

This research employed a quasi-experimental design to compare the effects of providing instant pumpkin soup supplemented with chicken breast (IPB) (n = 9) and the original recipe (IPO) (n = 9). The minimum sample size was determined using Lemeshow's experimental study formula. The study was conducted at the Santa Anna Nursing Home in North Jakarta for the IPB intervention and at Werdha Hanna in Bogor for the IPO intervention. Subjects were screened by a nurse based on inclusion criteria, including generally good health, no severe chronic diseases, the ability to perform daily activities independently, no lactose intolerance, no severe cognitive impairment, non-smokers, and not taking medications other than aspirin, NSAIDs, vitamin supplements, antihypertensive medications, or cholesterol-lowering drugs. Individuals were excluded from the study if they declined participation or did not complete the study.

2.2 Preparation of instant pumpkin cream soup

The preparation of instant pumpkin soup followed patent No. IDP000082075 with modifications. Two types of pumpkin cream soup were produced: IPB and IPO. The primary ingredients included pumpkin, carrots, onions, leeks, celery, chicken broth, unsalted butter, cooking cream, salt, pepper, and starch. The preparation began with producing chicken broth,

followed by mixing in seasonings, pumpkin, and carrots. The mixture was simmered with cooking cream, salt, and pepper until a puree was formed. For the IPB, chicken breast was added during the simmering process. Subsequently, before the puree was dried using a drum dryer to create sheets, rice flour was added. The sheets were then ground and sieved through a 60-mesh sieve to obtain powder.

2.3 Intervention procedures

Subjects were provided with 15 g (dry basis) of the instant pumpkin soup, which was rehydrated with 100 ml of water daily for 6 days a week. The amount of intervention was based on commercially available soup serving sizes, with distribution occurring weekly. To ensure compliance, the instant pumpkin soup was consumed collectively by the subjects with the assistance of caregivers, who ensured that the provided soup was fully consumed. Data were collected at both the beginning and end of the intervention.

2.4 Subject characteristics and constipation status

Data on age, gender, education level, and nutritional knowledge were collected using a structured questionnaire. The risk of malnutrition was assessed using the Mini Nutritional Assessment-Short Form (MNA-SF), while physical activity levels were determined using the Physical Activity Level (PAL) questionnaire.

2.5 Nutritional status and blood pressure measurement

Subjects' height and weight were measured using a stature meter (Seca 213, Germany) and a digital body scale (Omron BF 511, Japan), respectively. Height was measured with subjects barefoot, standing upright against a stadiometer, ensuring heels, buttocks, shoulders, and heads touched the surface, with heads in the Frankfort horizontal plane. Height was recorded to the nearest millimeter. Weight was taken with subjects in light clothing, standing centered on the scale, and recorded to the nearest 0.1 kg. These measurements were then used to calculate body mass index (BMI). Systolic and diastolic blood pressure were monitored using sphygmomanometer (Omron M6, Japan). Subjects were seated comfortably in a chair and had rested for at least 15 minutes prior to the measurement. The arm was bare and rested at heart level, with a properly sized cuff wrapped around the upper arm. Blood pressure measurements were taken twice, and the average of these readings was used to determine the subject's blood pressure.

2.6 Ethical approval

All procedures in this study were approved by the Ethics Committee of Universitas Muhammadiyah Semarang (No. 174/KE/03/2024).

2.7 Data analysis

Data regarding age, BMI, SBP, DBP, estimated duration of defecation, and Bristol score were presented as means \pm standard deviation. Other demographic variables, including gender, MNA-SF scores, nutritional knowledge, and physical activity levels, were reported as frequencies. The data were categorized into defined classifications: MNA-SF scores were classified as follows: 0–7 = malnutrition, 8–11 = at risk of malnutrition, and 12–14 = normal; nutritional knowledge scores were categorized as < 60 = poor, 60–79 = moderate, and \geq 80

= good; and physical activity levels were classified as < 1.7 = low, $1.7-1.99$ = moderate, and ≥ 2 = active. Differences between groups were assessed using independent t-tests for continuous variables (age, body weight, SBP, DBP, estimated duration of defecation, and Bristol score) and the Mann-Whitney test for ordinal data (education level, gender, MNA-SF scores, nutritional knowledge, and physical activity levels). Differences in endline measures and changes between groups were analyzed using ANCOVA, with baseline values and gender included as covariates. Statistical significance was defined as $p < 0.05$.

3 Results and discussion

3.1 Subject characteristics

The characteristics of subjects in both groups were generally comparable. No significant differences were observed in age, education level, gender, MNA scores, nutritional knowledge, and physical activity levels. The average age of subjects in the IPB group was 74.78 years, while that of the IPO group was 71.76 years. Most subjects in both groups had attained a high school education as their highest level, with none classified as malnourished. Nutritional knowledge was predominantly moderate to low, and participants engaged in light physical activity. Although not statistically significant, the IPO group had higher proportion of females (88.89%) compared to the IPB group (44.44%) (Table 1).

Subjects in this study were generally healthy with none classified as malnourished. However, the average age, exceeding 65 years, places the subject at an increased risk of developing cardiovascular diseases. According to Rodgers et al. [9], the risk of cardiovascular diseases increases after age 65, with a higher prevalence in females due to the decline of protective estrogen hormones. Consequently, the unequal gender distribution between the groups may pose a limitation of this study. A cohort study involving 3063 adults reported a significantly higher prevalence of obesity, hypertension, and metabolic syndrome significantly higher in females than in males after 60 years of age [10]. Furthermore, our findings are consistent with prior research that highlights relatively low nutritional knowledge and physical activity levels among the elderly [11,12].

Table 1. Subject characteristic distribution

Characteristics	IPB		IPO		p-value
	Mean	SD	mean	SD	
Age	74.78	6.33	71.76	6.69	0.77
	n	%	n	%	
Education levels					0.16
High school	6	66.67	8	88.89	
University	3	33.33	1	11.11	
Gender					0.05
Male	5	55.56	1	11.11	
Female	4	44.44	8	88.89	
MNA score					0.27
Malnutrition	0	0.00	0	0.00	
At risk	5	55.56	5	55.56	
Normal	4	44.44	4	44.44	
Nutritional knowledge					0.21
Good (≥ 80)	0	0.00	3	33.33	
Moderate (60-79)	4	44.44	4	44.44	

Table 1. Subject characteristic distribution (continue)

Poor (<60)	5	55.56	2	22.22	
Physical activity					0.61
Low	6	66.67	7	77.78	
Moderate	3	33.33	2	22.22	
Total	9	100.00	9	100.00	

Note: IPB = Instant Pumpkin Soup supplemented with chicken breast; IPO = Instant Pumpkin Soup made with original recipe. The age differences between groups were analyzed using an independent t-test. Differences in education level, gender, MNA scores, nutritional knowledge, and physical activity between groups were analyzed using the Mann-Whitney test.

3.2 Effect of instants pumpkin soups on nutritional status, blood pressure, and constipation

The impact of the 4-week intervention yielded notably different outcomes across the groups (Table 2). The IPB group experienced significant reductions in both systolic and diastolic blood pressure (SBP: -24.44 ± 18.78 mmHg; DBP: -12.22 ± 13.82 mmHg). Conversely, the IPO group demonstrated a non-significant decrease (-13.33 mmHg). Improvements were also observed in the estimated duration of defecation (IPB: -8.11 ± 4.43 minutes; IPO: -10.67 ± 7.25 minutes) and the Bristol score (IPB: 1.78 ± 0.67 ; IPO: 2.11 ± 0.78) across all groups (IPB: 5.11 ± 0.33 ; IPO: 6.00 ± 0.00). Although not statistically significant, both types of soup appeared beneficial for weight management (Table 2).

Table 2. Effect of soups on nutritional status, blood pressure and constipation status

Indicators	Time	IPB		IPO		p-value ^b
		mean	SD	mean	SD	
Body weight (kg)	Baseline	59.22	14.58	54.49	6.81	0.39
	Endline	59.07	13.81	53.70	4.6	<0.01
	Changes	-0.13	2.32	-0.80	2.73	0.59
	p-value ^a	0.85		0.41		
BMI (kg/m ²)	Baseline	22.39	3.49	22.40	2.62	0.99
	Endline	22.32	2.94	22.08	1.76	<0.01
	Changes	-0.07	0.94	-0.32	1.10	0.62
	p-value ^a	0.82		0.41		
Systolic blood pressure (mmHg)	Baseline	158.89	15.37	157.78	21.67	0.90
	Endline	134.44	14.24	144.44	24.55	0.31
	Changes	-24.44	18.78	-13.33	19.36	0.23
	p-value ^a	0.01		0.07		
Diastolic blood pressure (mmHg)	Baseline	102.22	9.71	94.44	14.24	0.19
	Endline	90.00	11.18	85.89	13.64	0.17
	Changes	-12.22	13.82	-13.33	15.81	0.87
	p-value ^a	0.02		0.58		
Estimated duration of defecation (minutes)	Baseline	15.00	5.00	17.56	7.42	0.20
	Endline	10.56	1.67	10.00	0.00	0.45
	Changes	-8.11	4.43	-10.67	7.25	0.38
	p-value ^a	0.02		0.02		
Bristol Score	Baseline	2.56	0.53	2.22	0.44	0.17
	Endline	5.11	0.33	6.00	0.00	<0.01
	Changes	1.78	0.67	2.11	0.78	0.35
	p-value ^a	<0.01		<0.01		

Note: IPB = Instant Pumpkin Soup supplemented with chicken breast; IPO = Instant Pumpkin Soup made with original recipe. ^aBaseline and endline differences were analyzed using ANCOVA adjusted

for baseline data. ^bDifferences in changes between groups were analyzed using ANCOVA adjusted for gender and baseline weight.

The ability of the instant pumpkin soup to lower blood pressure is attributed to its potassium content. Potassium plays a crucial role in blood pressure regulation through hyperpolarization of plasma membranes, which subsequently affects sodium reabsorption in distal nephrons. Additionally, potassium may help prevent arterial wall thickening. The pronounced effect of IPB on blood pressure is believed to stem from its modification, particularly the supplementation of the soup with chicken breast, which contains a significant amount of potassium (256 mg/ 100g), potentially enhancing the overall potassium content of the soup [13]. Moreover, chicken breast is a great source of arginine (1.24 g/100 g), which can help regulate blood pressure by enhancing of the production of nitric oxide. Additionally, a 52-week lifestyle intervention study found that systolic blood pressure was more sensitive to changes in the intervention and showed a stronger correlation with metabolic improvements, potentially due to its close relationship with heart function and arterial stiffness, compared to diastolic blood pressure [14].

This study also demonstrated that both types of soup improved constipation status. Yellow pumpkin soup, in particular, possesses a relatively high fiber content. The previous study reported that pumpkin flesh could contain 1.95% fiber [15]. Fiber is an essential component for facilitating defecation; it aids in increasing stool mass, enhancing gut microbiota, and promoting intestinal motility, thereby preventing constipation. Components in pumpkin, such as pectin and polysaccharides, may further contribute to alleviating constipation.

Additionally, this study indicates a positive impact on maintaining the body weight and nutritional status. Previous research has demonstrated the potential of pumpkin in preventing obesity. For instance, administering pumpkin extract over six weeks to high-fat diet induced-obese rats can significantly reduce triglycerides and LDL while increasing HDL [11]. Pumpkin contains a variety of bioactive compounds, including polysaccharides, para-aminobenzoic acid, sterols, polypeptides, and carotenoids, which contribute to a range of biological activities, including antioxidant and antihyperlipidemic effects [6].

4 Conclusion

This study demonstrates that pumpkin soup, in both its original and chicken breast-supplemented variations, can be a beneficial dietary alternative for improving the nutritional status and health of the elderly. Notably, the instant pumpkin soup with chicken breast showed a more favorable effect in regulating blood pressure, making it a potentially valuable addition to the diets of elderly individuals managing hypertension.

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