

# Impact of Conventional Salting and Roasting by Street Vendors on Nuts' Protein Content

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## ABSTRACT

Recent changes in dietary habits and studies demonstrating the abundance of significant macromolecules in nuts have sparked interest in evaluating their health benefits and composition under different conditions. In Palestine, street vendors sell nuts that have been salted and roasted using a traditional method, yet there is little information available on the effects of this processing technique on the macromolecules content of these nuts. The aim of this study is therefore to investigate the protein content of different types of nuts before and after salting and roasting. Our findings indicate that salting and roasting method employed by street vendors reduces the protein content of almonds, cashews and walnuts, aligning with previous reported data on industrial grade salting and roasting. Further research is necessary to assess the impact of this processing method on other bioactive macromolecules and to determine whether retaining an intact nut shell (pericarp) during salting and roasting provides an advantage over nuts processed after losing their outer nut shell.

## Introduction

The growing recognition of the health benefits, nutraceutical properties and favorable taste of nuts has established them as a staple food option [1]. Nuts are rich in essential bioactive macromolecules including proteins, carbohydrates, fibers, minerals, tocopherols, phytosterols and phenolic compounds [1,2]. Nuts consist of dried seeds and their production has increased substantially in recent decades [3]. Nutritionists emphasize the health benefits of nuts highlighting the abundant monounsaturated and polyunsaturated fatty acids, vitamins E and K, selected minerals such as magnesium, copper, potassium and selenium, dietary fiber, carotenoids and phytosterols with potential antioxidant effects [1,4,5]. Clinical studies investigating the health benefits of nuts have found that daily consumption of a moderate amount of peanuts (43 g/day) lowers blood pressure, cholesterol, and triglycerides in participants with elevated serum lipids and hy-

pertension. Another study reported that eating peanuts twice a week and walnuts once a week was associated with a 13-19% reduction in total cardiovascular disease [6-9]. Proteins are essential macronutrients that play a crucial role at various cellular, tissue, and organ levels in humans. They are vital for growth and repair mechanisms in tissues, fundamental for muscle growth, and the maintenance of healthy skin, hair, and nails, as well as overall health. Protein intake helps with weight control as it contributes to a feeling of satiety, given that our bodies use more energy to digest and absorb proteins compared to other macromolecules [10]. Recent changes in eating habits show that more and more people are favoring plant-based foods over animal-based foods [11]. As a result, interest in nuts as an important alternative source of protein has increased. In Palestine, nuts are sold in retail markets and by street vendors without being labeled with nutritional information. This study aims to evaluate the total protein content of different nuts, namely cashew (*Anacardium occidentale*),

walnuts (*Juglans regia*), almonds (*Prunus dulcis*), pistachios (*Pistacia vera*) and peanuts (*Arachis hypogaea*). Additionally, we will compare the impact of the most commonly used processing method by street vendors, traditional salting and roasting, on the protein content of these nuts.

## Materials and Methods

### Raw Materials and Salting and Roasting Process

The nuts were bought from a retailer in the city of Hebron, Palestine. The nuts were selected from the same patch and labeled as raw nuts before processing, while the processed patch were labeled as roasted and salted (rs). These nuts were processed using the standard procedures commonly used by street vendors of nuts. The nuts were soaked in highly concentrated table salt solution for 6 hours and then roasted in an oven at 200 degrees for 30 minutes.

### Simple One Step Method for Protein Extraction

1g of powdered nut sample was weighed and grinded further with mortar and pestle while 9ml of protein extraction buffer (1%SDS, 50mM Tris-HCl pH 8, 250mM sucrose) was added. The material was then transferred to 15 ml conical tubes, vortexed for 5 minutes and allowed to stand at room temperature for 1 minute. It was then centrifuged at 4000 rpm for 10minutes. Supernatant was then used to estimate protein content.

### Folin-Lowry Protein Assay and Protein Estimation and Calculations

We used the Folin-Lowry method for protein determination according to the original protocol [12] and with a slight modification published in [13]. For the standard curve, human serum albumin in a stock solution of 0.2 mg/ml was used to prepare the dilutions with known protein content. Their absorbance at 700 nm was measured with a spectrophotometer to create the standard curve. Our unknown samples (protein extracts) were diluted 1:100 and their absorbance was also measured using the spectrophotometer. The equation of the standard curve was used to estimate the protein content in our diluted unknown samples. Then this concentration was multiplied by the total dilution factor 1000 to estimate the mg protein content in each gram of the samples(mg protein/g nuts). The standards were measured a total of 3 times independently, and the unknown samples were measured twice.

Standard curve equation:

$$y = 3,902x + 0,0019$$

$$R^2 = 0,9949$$

### Statistical Analysis

The total protein content in 1 g of raw nut was considered the total protein content of nuts that was compared to previously reported

data. The mean of two measurements for raw and salted and roasted (rs) nuts respectively was used for Figure1. The statistical comparison of the protein content of raw and salted-roasted (rs) nuts was performed using the Student t-test and only a P-value of  $P < 0.05$  was considered significant.

## Results

### Assessing The Validity of Simple Protein Extraction Method

To assess whether our simple and rapid protein extraction method effectively extracted most of the protein content from the finely ground nut samples, we compared our total protein estimate for raw nuts to the previously published values [1]. Our findings revealed that peanuts contained the highest percentage of protein by weight (20%) while pistachios surprisingly had the lowest (12%) (Table 1). The protein content of these nuts was consistent with previously reported values, with the exception of pistachio, which differed by more than 8%. This suggests that the pistachio sample may have been of lower quality and naturally contained less protein than typically reported.

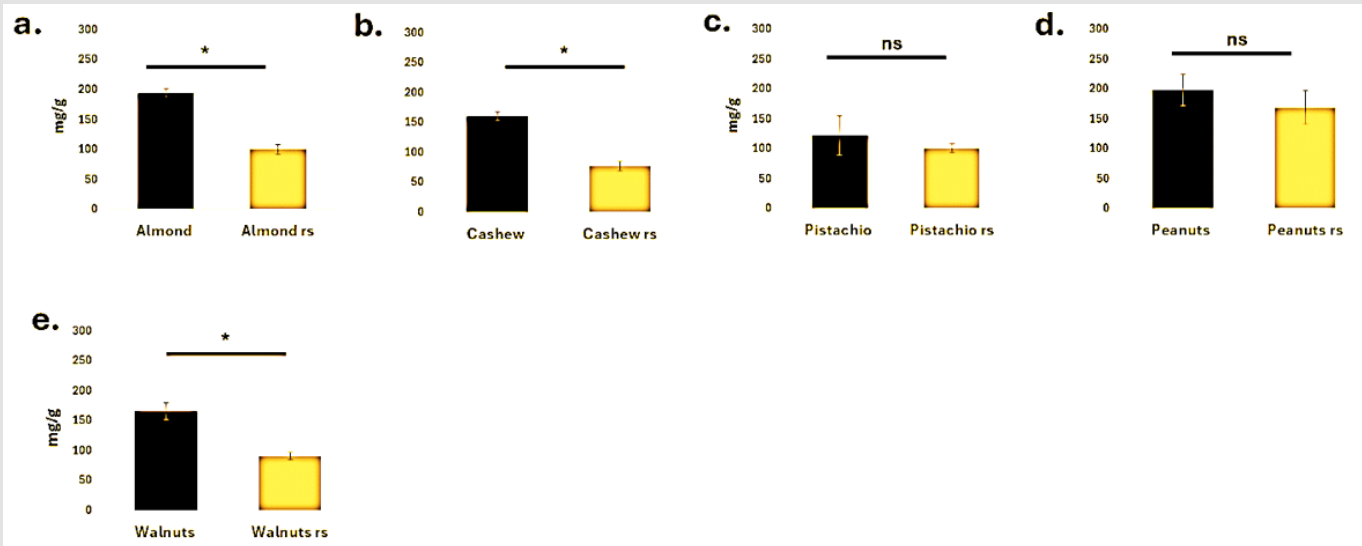
**Table1:** This table shows the percent protein of different raw nuts (% protein) and % protein previously reported for selected nuts. The previously reported data were obtained from (Gonclaves, et al. [1]).

Nut	% Protein	% protein (previously reported)
Almonds	19.40%	16.8-25.4%
Cashews	16%	17.5-19.0%
Peanuts	20%	25.4%
Pistachios	12%	19.4-22.1%
Walnuts	16.50%	14.4-16.0%

### Protein Content of Raw Vs Salted-Roasted Nuts

Our goal is to compare the protein content of raw nuts with nuts that were salted and roasted using a method employed by street vendors. Salting and roasting seem to reduce the total protein content of nuts (Figure 1). This decrease is notably different for almonds, cashews and walnuts (Figure 1a, 1b & 1e, respectively). Conversely, the protein content of raw and salted, roasted pistachios and peanuts were not significantly different (Figure 1c & 1d, respectively).

These results support previously reported data indicating that salting and roasting lowers the protein content of these nuts, suggesting that traditional salting and roasting does not offer any advantage over the industrial, large scale salting and roasting process [2,3,14]. Almonds, pistachios and peanuts were all salted and roasted with their intact nut shells (pericarp). While pistachios and peanuts appeared to be unaffected and had no significant change in their total protein content(Figure 1c & 1d), almonds experienced a significant decrease in total protein content after salting and roasting, despite retaining the nutshell during the process (Figure 1a).



**Figure 1:** Estimation of the protein content of raw nuts and salted, roasted nuts, for

- (a) Almonds,
- (b) Cashews,
- (c) Pistachios,
- (d) Peanuts, and
- (e) Walnuts.

The estimation of protein content was performed on raw nuts or on salted and roasted nuts portions based on the information provided by a street vendor (see Material and Methods). These measurements were repeated twice. Significant differences were determined using Student's t- test; \* $P < 0.05$ , .  $P > 0.05$ , not significant (ns).

## Conclusion

Nut street vendors in the West Bank, Palestine, commonly use a traditional method of salting and roasting that confirms the previously reported decrease in total protein content of nuts after processing. Salting and roasting with the nutshell intact seems to protect the nuts from the protein degradation and loss associated with salting and roasting as seen in pistachios and peanuts (Figure 1c & 1d), although not completely as is the case with almonds (Figure 1a). This initial investigation highlights the need for further research to assess the impact of this traditional salting and roasting technique on other essential macromolecules such as carbohydrates, antioxidants and vitamins, among others. Conducting such studies will provide nutritionists with comprehensive data on the effects of this commonly used salting and roasting method on these nuts, enabling them to offer more informed recommendations regarding their health benefits.

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