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# Quantitative Determination of Sodium and Potassium Ions in Ready to Eat Commercially Available Food Products

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**Abstract - Ready to eat foods products like noodles, pasta, oats and soups have become a part of our everyday life because they are quick to prepare and easy to store. But most of these foods are made with a large amount of salt, and regular eating of such foods can disturb the balance between sodium and potassium in our body. A high sodium to potassium ratio is known to increase the risk of high blood pressure, heart disease and kidney problems. Keeping this in mind, the present work was carried out to find out the actual amount of sodium ($Na^+$) and potassium ($K^+$) ions present in nine commercially available ready to eat food products three brands of noodles, two brands of soup, two brands of oats and two brands of pasta. The determination was done using flame photometry. When the sample solution is sprayed into a flame, the heat of the flame excites the metal atoms, and when these excited atoms come back to their normal state, they give out light of a particular colour and wavelength which is characteristic of that metal only. The intensity of this emitted light is directly proportional to the concentration of that ion in the solution, and by comparing this intensity with the intensity of known standard solutions, the unknown concentration can be found out from the calibration curve.**

**Keywords : Ready to eat food products, Flame photometry, Calibration curve, Na:K ratio.**

## 1. INTRODUCTION

Modern dietary patterns, increasingly characterized by the overconsumption of ultra-processed foods, refined sugars, and unhealthy fats, have been strongly linked to adverse health outcomes[6]. The sodium–potassium (Na: K) ratio in the human diet has emerged as a critical biomarker for assessing cardiovascular and metabolic health. Sodium (Na) and potassium (K) are essential electrolytes that play interdependent roles in maintaining physiological homeostasis, including fluid balance, nerve transmission, and muscle function. However, modern dietary patterns, characterized by excessive sodium intake and inadequate potassium consumption, have disrupted this balance, elevating the Na: K ratio to levels associated with increased risks of hypertension, cardiovascular disease (CVD), stroke, and chronic kidney disease (CKD)[2]. The World Health Organization (WHO) recommends a daily sodium intake of less than 2000 mg (5 g of salt) and a potassium intake of at least 3500 mg, translating to a Na: K ratio of approximately 0.57. Yet, global adherence to these guidelines remains poor, with populations often consuming ratios exceeding 1.5, driven by processed and ultra-processed foods and insufficient fruit and vegetable intake[1,5]. Despite the current dietary guidelines, average sodium intake remains significantly above recommendations, whereas potassium intake is often far below optimal levels in both developed and developing nations. Historically, sodium reduction has been the targeted strategy for public health interventions to reduce population BP. Food manufacturers have been using potassium chloride (KCl) and other potassium-containing ingredients as a tool to reduce sodium over the years, but new understanding of potassium's critical role and efficacy in reducing BP calls for a paradigm shift to consider sodium and potassium together when developing recommendations.[4]

## 2.METHODOLOGY

### 2.1 Collection of samples:

The commercially and readily available brand samples of ready to eat food products like Noodles (3 brands), Soups (2 brands), Oats (2 brands) and Pasta (2 Brands) with criteria of not being older than 3 months with respect to manufacturing date, were collected (purchased) from the reliable mega market stores.



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### 2.2 Preparation of solutions:

#### 2.2.1 Digestive condition:-

A known quantity of sample (5g) was soaked for about 30 mins in warm (70-78°C) 0.1N HCl solution and then boiled for 15 minutes. Then the obtained solution was filtered through Whatman Filter paper and finally diluted to 100 $cm^3$ with distilled water.

#### 2.2.2. Ashing and solution of white ash:-

A known quantity of sample (10g) was ashed in the furnace at 800-900°C till complete white ash was obtained (about 10 to 12 hrs). Then the obtained white ash was transferred to the Borosil beaker and by adding 10 $cm^3$ concentrated HCl was heated on sand bath to evaporate the HCl completely, the same step is repeated one more time and finally the obtained residue is extracted in 20 - 30 $cm^3$ distilled water by boiling for 10 to 12 minutes. The obtained solution is then filtered through Whatman Filter paper finally diluted to 100 $cm^3$ with distilled water.

## 3. EXPERIMENTAL DETAILS:-

Systronics Flame Photometer was used for the measurement of emission intensity of all the prepared samples. The emission intensity was measured for $Na^+$ and $K^+$ ions present in the sample solution using calibration curve method. AR grade oven-dried NaCl and KCl was used to prepare the calibration curve in the range of 20 to 200 ppm with respect to $Na^+$ and $K^+$ ions.

Samples whose responses exceeded the highest calibration standard (above the upper limit of quantification) were appropriately diluted, re-analysed within the calibration range, and the results were multiplied by the respective dilution factor.

## 4. OBSERVATIONS:-

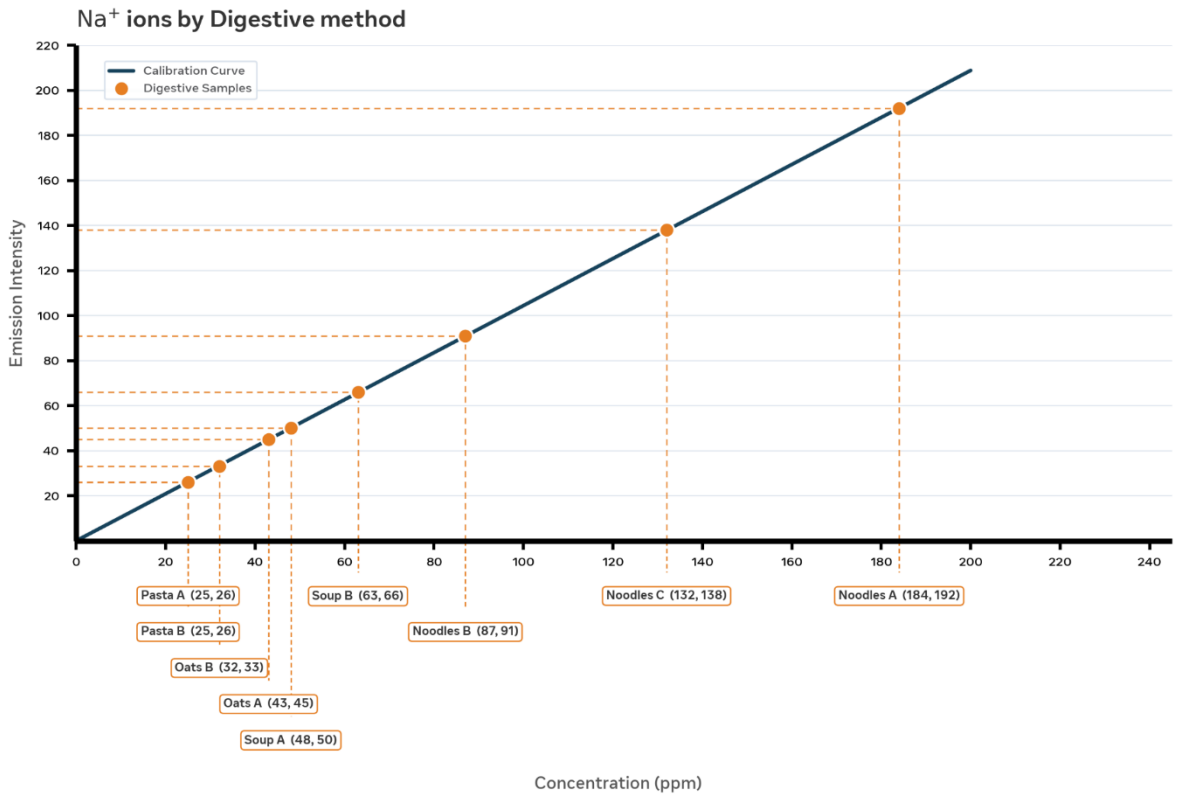



Figure 1: Plot of Emission Intensity vs. Concentration (ppm) for $Na^+$ ions by digestive method.



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Table 1: Amount of $Na^+$ ions calculated by graph ( Figure 1) by digestive method

| Sample | Emission Intensity | Concentration (ppm) By graph |
|---|---|---|
| **Noodles A** | 192 | 184 |
| **Noodles B** | 91 | 87 |
| **Noodles C** | 138 | 132 |
| **Pasta A** | 26 | 25 |
| **Pasta B** | 26 | 25 |
| **Oats A*** | 45 | 43 |
| **Oats B*** | 33 | 32 |
| **Soup A*** | 50 | 48 |
| **Soup B*** | 66 | 63 |

[Samples marked * exceeded the calibration range, so they were diluted 20 times before measurement ]

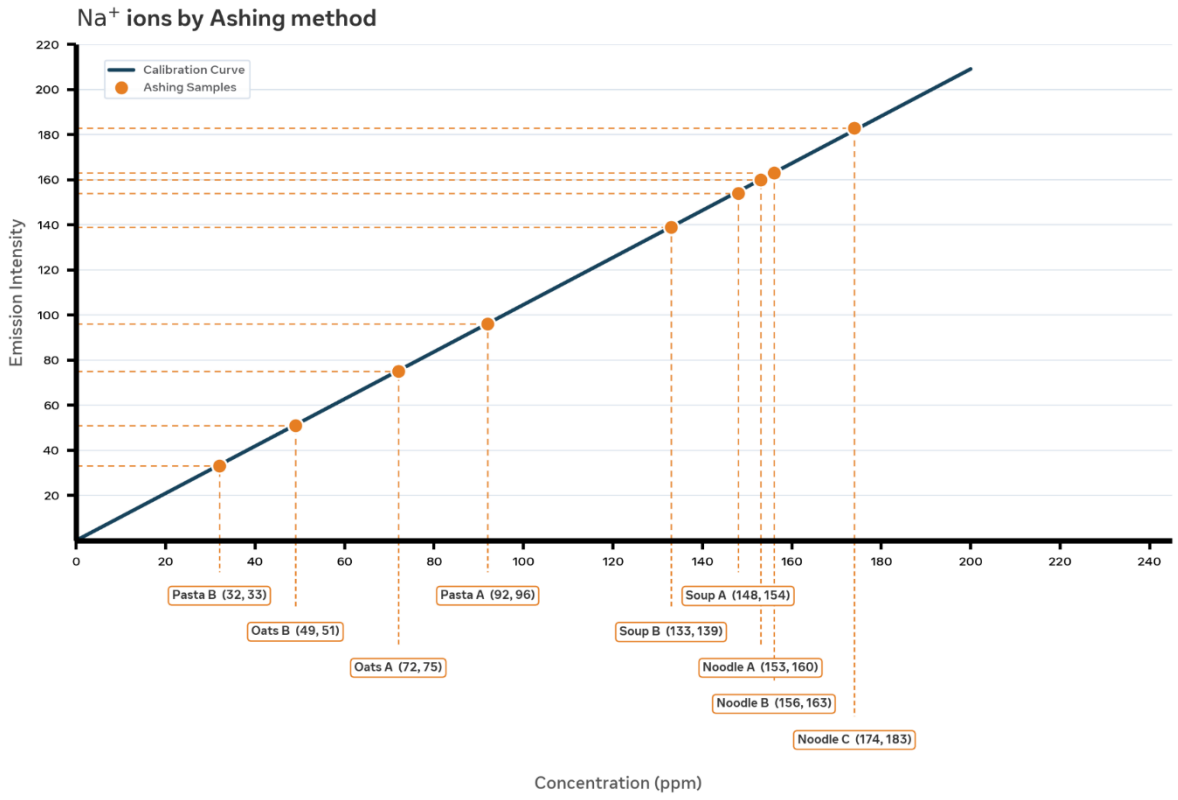



Figure 2: Plot of Emission Intensity vs. Concentration (ppm) for $Na^+$ ions by Ashing method.

Table 2: Amount of $Na^+$ ions calculated by graph ( Figure 2 ) by Ashing method



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| Sample | Emission Intensity | Concentration (ppm) By graph |
|---|---|---|
| **Noodles A** | 160 | 153 |
| **Noodles B** | 163 | 156 |
| **Noodles C** | 183 | 174 |
| **Pasta A*** | 96 | 92 |
| **Pasta B** | 33 | 32 |
| **Oats A*** | 75 | 72 |
| **Oats B*** | 51 | 49 |
| **Soup A*** | 154 | 148 |
| **Soup B*** | 139 | 133 |

[Samples marked * exceeded the calibration range, so they were diluted 20 times before measurement ]

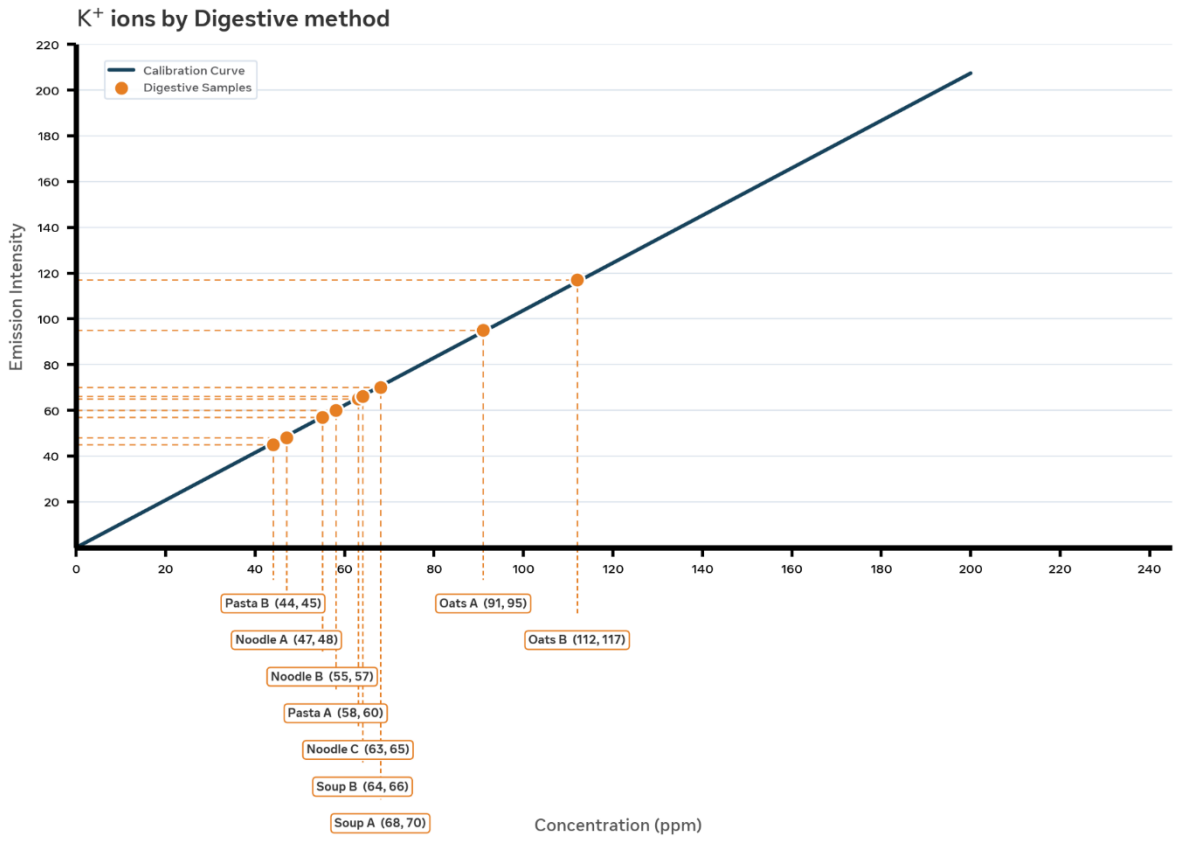



Figure 3: Plot of Emission Intensity vs. Concentration (ppm) for $K^+$ ions by digestive method.



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Table 3: Amount of $K^+$ ions calculated by graph ( Figure 3) by digestive method

| Sample | Emission Intensity | Concentration (ppm) By graph |
|---|---|---|
| **Noodles A** | 48 | 47 |
| **Noodles B** | 57 | 55 |
| **Noodles C** | 65 | 63 |
| **Pasta A** | 60 | 58 |
| **Pasta B** | 45 | 44 |
| **Oats A** | 95 | 91 |
| **Oats B** | 117 | 112 |
| **Soup A** | 70 | 68 |
| **Soup B** | 66 | 64 |

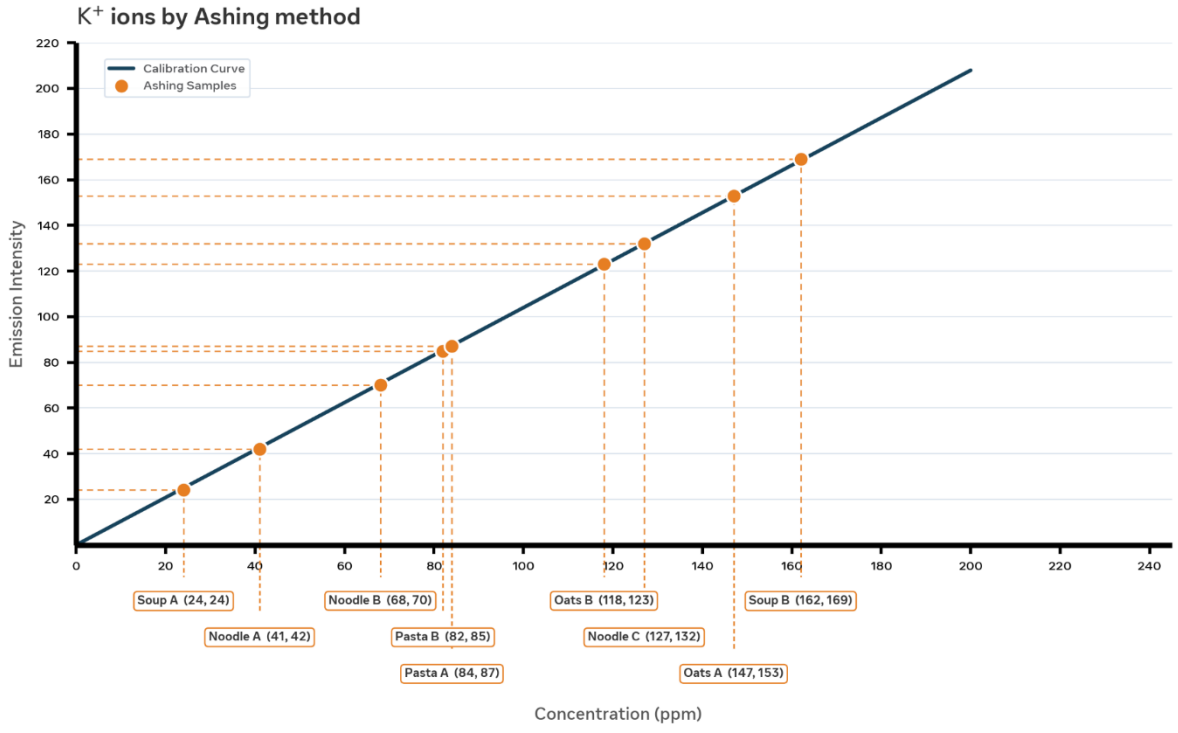



Figure 4: Plot of Emission Intensity vs. Concentration (ppm) for $K^+$ ions by Ashing method.



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International Journal of Engineering Research & Technology (IJERT)
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Table 4: Amount of $K^+$ ions calculated by graph ( Figure 4 ) by Ashing method

| Sample | Emission Intensity | Concentration (ppm) By graph |
|---|---|---|
| Noodles A | 42 | 41 |
| Noodles B | 70 | 68 |
| Noodles C | 132 | 127 |
| Pasta A | 87 | 84 |
| Pasta B | 85 | 82 |
| Oats A | 153 | 147 |
| Oats B | 123 | 118 |
| Soup A* | 24 | 24 |
| Soup B | 169 | 162 |

[Samples marked * exceeded the calibration range, so they were diluted 20 times before measurement ]

## 5. RESULTS

Digestive method (5 g in 100 $cm^3$): mg in 1 g = Concentration (ppm) × 0.1 / 5 × Dilution Factor = ppm × 0.02 × Dilution Factor

Ashing method (10 g in 100 $cm^3$): mg in 1 g = Concentration (ppm) × 0.1 / 10 × Dilution Factor = ppm × 0.01 × Dilution Factor

Table 5 : Concentration of $Na^+$ Ions (mg in 1 g of Sample) by Digestive Method.

| **Sample** | **Concentration (mg in 1 g of sample)** |
|---|---|
| Noodles A | 3.68 |
| Noodles B | 1.74 |
| Noodles C | 2.64 |
| Pasta A | 0.5 |
| Pasta B | 0.5 |
| Oats A | 17.2 |
| Oats B | 12.8 |
| Soup A | 19.2 |
| Soup B | 25.2 |



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Table 6: Concentration of $Na^+$ Ions (mg in 1 g of Sample) by Ashing Method

| **Sample** | **Concentration (mg in 1 g of sample)** |
|---|---|
| Noodles A | 1.53 |
| Noodles B | 1.56 |
| Noodles C | 1.74 |
| Pasta A | 18.4 |
| Pasta B | 0.32 |
| Oats A | 14.4 |
| Oats B | 9.8 |
| Soup A | 29.6 |
| Soup B | 26.6 |

Table 7 : Concentration of $K^+$ Ions (mg in 1 g of Sample) by Digestive Method.

| **Sample** | **Concentration (mg in 1 g of sample)** |
|---|---|
| Noodles A | 0.94 |
| Noodles B | 1.1 |
| Noodles C | 1.26 |
| Pasta A | 1.16 |
| Pasta B | 0.88 |
| Oats A | 1.82 |
| Oats B | 2.24 |
| Soup A | 1.36 |
| Soup B | 1.28 |



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Table 8: Concentration of $K^+$ Ions (mg in 1 g of Sample) by Ashing Method.

| Sample | Concentration (mg in 1 g of sample) |
|---|---|
| Noodles A | 0.41 |
| Noodles B | 0.68 |
| Noodles C | 1.27 |
| Pasta A | 0.84 |
| Pasta B | 0.82 |
| Oats A | 1.47 |
| Oats B | 1.18 |
| Soup A | 4.8 |
| Soup B | 1.62 |

## 6. CONCLUSIONS

All the samples contain both $Na^+$ and $K^+$ ions, but in different amounts. No two samples gave the same result.

By the digestive method, the highest sodium was found in Soup B (25.2 mg in 1 g of sample), followed by Soup A (19.2 mg/g) and Oats A (17.2 mg/g), while the lowest was found in Pasta A and Pasta B (0.5 mg/g). By the ashing method, the highest sodium was found in Soup A (29.6 mg/g) and Soup B (26.6 mg/g). Potassium was found to be comparatively low in all the samples, with the highest value in Oats B (2.24 mg/g) by digestive method and in Soup A (4.8 mg/g) by ashing method.

Pasta A ($Na^+$) and Soup A ($K^+$) showed unusually high values by ashing method, which may be due to sample heterogeneity or contamination.

Sodium was found to be much higher than potassium in most of the samples, especially in soups and oats. This shows that the Na:K ratio in these foods is on the higher side as recommended by WHO which is not desirable from the health point of view[1, 2, 5]. The values obtained by ashing method were, in most cases, higher than those obtained by digestive method. This is probably because in digestive method, the ions are not completely extracted from the food matrix, whereas in ashing method, the organic matter is completely removed and the ions are fully brought into solution.

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