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Presence of Intestinal Parasites in Cabbage (B. oleracea var. capitata) Sold at Public Market

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ABSTRACTS

This study aimed to ascertain the existence of intestinal parasites in raw cabbage vegetables sold at the public market in Isulan, Sultan Kudarat, Philippines, and examined using various treatments. This study took a quantitative approach and was established using a Completely Randomized Design (CRD). There were five (5) treatments replicated three (3) times. Soaking, sedimentation, and centrifugation were performed on the cabbage samples. The intestinal parasites were detected using a microscope, with a glass slide containing a drop of suspension mixed with a drop of Lugol's Iodine placed on the microscope's stage. Results of the investigation revealed the presence and number of intestinal parasites found in cabbage samples per treatment used in the study. It was found that the number of intestinal parasites identified in cabbage differs significantly across the various treatments used, and Treatment 1 has the highest average of intestinal parasites found in cabbage. Additionally, the experiment discovered intestinal parasites in 33.33% of cabbage samples. Thus, the investigation ascertained that intestinal parasites are discovered in raw cabbage vegetables sold at the Isulan public market.

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1. INTRODUCTION

Intestinal parasites are responsible for the majority of illnesses and loss of life globally. These parasites can be spread by raw sewage, soil, and foods, for instance, fruits and vegetables if ingested raw and not properly washed (Salamandane *et al*., 2021). One of the main sources of human disease is vegetables (Rao & Rao, 2007), particularly those eaten raw and not thoroughly rinsed. When contaminated by various factors associated with cultivation, such as those in the crop, collection, transport, preservation, marketplace, and even household, fresh greens play a critical role in the parasitic conveyance of infectious agents (Tefera *et al*., 2014). Ingestion of unwashed fresh vegetables and fruits, on the other hand, can greatly increase the risk of foodborne illness (Alvarado-Esquivel *et al*., 2011). Since the majority of fresh veggies purchased in marketplaces are grown on public lands, they are exposed to a wide range of pollutants from the time they are collected, distributed, transported, and stored until they are purchased by a buyer.

Furthermore, there is no previously published data on the contamination of cabbage, particularly in the province. Thus, this research intended to assess the presence of intestinal parasites in cabbage sold in Isulan, Sultan Kudarat, Philippines. The study may provide critical information to stakeholders regarding the potential contamination of cabbage. The findings may lead to improved vegetable handling, washing, and preparation techniques that protect customers from parasitic infections in their intestines.

2. METHODS

The research was conducted in an experimental setting. The experimental nature detects the presence and number of intestinal parasites in cabbage samples sold at Isulan's public market, as well as the significant differences between the various treatments.

2.1. Setting-up of the experiment

The experiment was set up following the study's experimental layout. The procedure of soaking was executed where two hundred grams (200 g) of chopped cabbage samples were placed separately in a bucket and soaked with the different treatments. The chopped cabbage was then immersed in liquid and left overnight to sediment. After 24 hours of soaking, the top layer of the sedimented liquid was discarded, and the remaining was moved into a 10 milliliter (ml) test tube, where it underwent the process of centrifugation at a speed of 2000 revolutions per minute (rpm) for five (5) minutes. The clear liquid found above the solid residue was removed after centrifugation, and the residue had been resuspended. A drop of the suspension was placed in the center of a glass slide, followed by a droplet of Lugol's iodine. The slide was then placed on the stage of the microscope and the subject was scrutinized with X10 and X40 or 40x/0.65 objectives.

2.2. Experimental design and treatment

This study took a quantitative approach, and it was established using a Completely Randomized Design (CRD). Additionally, there were five (5) treatments in this study with three (3) replications. These treatments were used to test the presence of intestinal parasites in cabbage samples that were assigned to treatment groups at random. The treatments were as follows:

Treatment 1 – 1 L of saline solution with 75% salt
Treatment 2 – 1 L of saline solution with 50% salt

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Treatment 3 – 1 L of saline solution with 25% salt
Treatment 4 – 1 L of normal saline
Treatment 5 – 1 L of distilled water

2.3. Data gathering procedure

The data gathered in this study, as well as the procedure for collecting it, are as follows:

(i) Presence of intestinal parasites. This was identified by examining cabbage samples using five (5) treatments replicated three (3) times, and the results were expressed or interpreted using the following grading, there are: "none" (0), "rare" (0–2), "few" (2–5), "moderate" (5–20), and "many" (> 20).
(ii) Percentage of the presence of intestinal parasites. This was determined by identifying the number of cabbage samples with the presence of intestinal parasites, and then it was divided by the number of samples examined in the study and multiplied by 100.
(iii) Many intestinal parasites. This was determined by we using a microscope. Soaking of cabbage samples, sedimentation, and centrifugation was conducted before placing the subject under the microscope for the investigation.

2.4. Statistical treatment

The statistical analyses were performed using one-way ANOVA in a completely randomized design (CRD) to determine whether the different treatments used differed significantly in terms of the number of intestinal parasites found in cabbage sold at the public market in Isulan, Sultan Kudarat, Philippines. Fisher's Least Significant Difference (LSD) test was utilized to check where the differences between treatments occurred. Additionally, to establish the significant difference between treatments at a significance level of 0.05.

3. RESULTS AND DISCUSSION

Table 1 displays the results for the presence of intestinal parasites found in cabbage samples examined using various treatments in the study. The findings revealed that Treatment 1 Replication 1, Treatment 1 Replication 2, and Treatment 4 Replication 1 have the highest detected presence of intestinal parasites, which are reported as "moderate" among all treatments and replications. Followed by Treatment 1 Replication 3 and Treatment 3 Replication 2, which are reported as "few." Additionally, Treatment 2 with all replications, Treatment 3 Replication 1, Treatment 3 Replication 3, Treatment 4 Replication 2, Treatment 4 Replication 3, and Treatment 5 with all replications have no presence of intestinal parasites and therefore they are all reported as "none."

Table 1. Results for the presence of intestinal parasites found in cabbage.

Treatments	Replication 1	Replication 2	Replication 3	Presence (%)
Treatment 1	Moderate	Moderate	Few	
Treatment 2	None	None	None	
Treatment 3	None	Few	None	33.33%
Treatment 4	Moderate	None	None	
Treatment 5	None	None	None	

Moreover, the presence of intestinal parasites was also expressed as a percent (%), as shown in the last column of **Table 1**. Hence, we determined the percentage of the presence of intestinal parasites in all of the treatments. Out of fifteen (15) cabbage samples, there were

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a total of five (5) cabbage samples detected with the presence of intestinal parasites. As a result, 33.33% of the cabbage samples have been detected the presence of intestinal parasites during the examination conducted.

Table 2 shows the results for the number of intestinal parasites that were found in cabbage samples examined using different treatments in the study. Hence, the total number of intestinal parasites found in cabbage in Treatment 1 is thirty-seven (37), "many" (> 20). Treatment 2 has zero results for the number of intestinal parasites in all replications, therefore it is free of intestinal parasites, "none" (0). A total of five (5) intestinal parasites were found in Treatment 3, particularly only in Replication 2, "few" (2-5). Treatment 4 has a total of seven (7) intestinal parasites found in the cabbage sample tested in Replication 1, "moderate" (5-20). Lastly, no intestinal parasites were found in Treatment 5, "none" (0). Additionally, the mean of the results for Treatment 1 is equal to 12.333, 1.667 for Treatment 3, and 2.333 for Treatment 4. While, for Treatment 2 and Treatment 5, the mean of their results is equal to 0. Therefore, Treatment 1 has the largest calculated mean.

Consequently, Treatment 1 (1 L of saline solution containing 75% salt) with thirty-seven intestinal parasites is found to be the treatment with the largest detected number of intestinal parasites found in cabbage. Followed by treatments 3 and 4 with five and seven intestinal parasites, respectively. With that being said, treatments 1, 3, and 4 revealed the existence of intestinal parasites in cabbage vegetables sold at the public market in Isulan, Sultan Kudarat, Philippines. The investigation for the existence of intestinal parasites using the various treatments in the study ascertained that intestinal parasites are discovered in cabbage.

Table 2. Results for the number of intestinal parasites found in cabbage.

Treatments	Replication 1	Replication 2	Replication 3	Total	Mean	Interpretation
Treatment 1	16	17	4	37	12.33	Many
Treatment 2	0	0	0	0	0.00	None
Treatment 3	0	5	0	5	1.67	Few
Treatment 4	7	0	0	7	2.33	Moderate
Treatment 5	0	0	0	0	0.00	None

Table 3 presents the results of the one-way ANOVA test for the number of intestinal parasites found in cabbage. Results show that the number of intestinal parasites found in cabbage differs significantly depending on the treatment utilized. Since the F-computed value = 5.21 is larger than the F-tabulated value = 3.48 at a level of significance a = 0.05, the null hypothesis (H0) of the study is rejected and the alternative hypothesis (Ha) is accepted. Therefore, there is a significant difference in the number of intestinal parasites found in cabbage between the different treatments used in the study.

Fisher's Least Significant Difference (LSD) Test for **Table 3** is displayed above. Fisher's LSD, which stands for the Least Significant Difference, was used as a post-hoc test. Treatment 1 (1 L of saline solution with 75% salt) revealed mean difference |I-J| values of 12.333 and 10.667, which are both statistically significant because both values are greater than the value of LSD, which is 7.139. Other treatments either have varying results or are not significant. However, treatment 1 is solely significant.

Based on the results presented, Treatment 1 has the highest average of intestinal parasites found in cabbage (B. oleracea var. capitata) and it is substantially higher compared to other treatments at a = 0.05 level of significance. Treatment 1 revealed the highest presence of intestinal parasites, which proves that there is indeed the existence of intestinal parasites

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detected in cabbage vegetables sold at the public market in Isulan, Sultan Kudarat, Philippines.

On top of that, findings of other studies had also revealed the existence of intestinal parasites in cabbage. According to Tefera *et al*. (2014), the most frequently contaminated vegetable was cabbage. Cabbage had a parasitological contamination level of 68.9%. This variation in other vegetables could be attributed to cabbage's uneven surfaces, which allow parasite stages to attach more easily to them. Thus, improper vegetable handling and practices, exposure to harvest before or during acquisition, water supply, and soil stored before harvest could all have contributed to the contamination (Vizon *et al*., 2019). Furthermore, increasing public awareness and monitoring food quality by community public entities is recommended for the betterment of the public to improve health and stability and prevent infection.

Table 3. Fisher's least significant difference (lsd) test.

Treatments (I)	Mean	Treatments (J)	Mean Difference |I-J|	LSD at 0.05	Interpretation
Treatment 1	12.33	Treatment 2	12.33	7.14	Significant
		Treatment 3	10.67		Significant
Treatment 2	0.00	Treatment 3	1.67		Not Significant
		Treatment 4	2.33		Not Significant
Treatment 3	1.67	Treatment 4	0.67		Not Significant
		Treatment 5	1.67		Not Significant
Treatment 4	2.33	Treatment 5	2.33		Not Significant
		Treatment 1	10.00		Significant
Treatment 5	0.00	Treatment 1	12.33		Significant
		Treatment 2	0.00		Not Significant

4. CONCLUSION

Intestinal parasites were present in cabbage vegetables sold at the Isulan public market as they were discovered in 33.3% of cabbage samples. The results of tests of cabbage samples for the presence and number of intestinal parasites varied since they were examined according to the different treatments. Hence, it was revealed that there is a significant difference in the number of intestinal parasites found in cabbage between the different treatments used. Therefore, the investigation ascertained that intestinal parasites were discovered in cabbage sold at the public market in Isulan, Sultan Kudarat, Philippines. Based on the findings, we made the following recommendations.

(i) Future research should look into other ways or additional variables to test the presence of intestinal parasites in cabbage.
(ii) Other vegetables, particularly those that are often ingested raw, can also be tested for the presence or number of intestinal parasites.
(iii) Further investigations may be undertaken to further evaluate the findings of this study.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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