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CHARACTERIZATION OF LOCAL AND IMPORTED FLOUR BASED ON THEIR MINERAL CONTENT AND SOME PHYSICOCHEMICAL PARAMETERS

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Abstract

Research on the mineral content and physicochemical parameters of flour is important for understanding the nutritional value, health implications, processing characteristics, and product development of flour-based food products. This study aimed to determine the physicochemical properties of 20 local and imported flour samples offered in the markets of Kosovo.

Flour samples were classified into two groups based on their geographical origin: local flour (LF) produced within the country and imported flour (IF) brought in from other countries. The study involved the analysis of flour samples using microwave plasma atomic emission spectroscopy (MP-AES) to determine various physicochemical parameters (moisture content, free acidity, fat, proteins, ash, cellulose, gluten, and starch) as well as macroelements (Ca, K, Mg, Na, P, Fe, Mn, Cu, and Zn. The t-test for independent samples was used to determine the significance level of the dependent variable. Statistical analysis was performed using SPSS (Social Package for Social Sciences) software.

The results showed that there was a significant difference ($p < 0.01$) between LF and IF in physical and chemical properties. The physicochemical results show that the imported flour has significantly higher fat and protein content, while the domestic flour has higher starch content compared to the imported flour. In terms of macroelements content, calcium (Ca), potassium (K), magnesium (Mg), and copper (Cu) were the elements found in higher amounts in imported flour than in domestic flour.

This research can have significant implications for the food industry and public health by providing valuable information about the safety, nutritional value, and quality of different types of flour. It can help to improve food product quality, promote public health, and stimulate economic growth in the food industry.

***Key words**: Flour, Local (Kosovo), Imported, Physicochemical, Macroelements.*

1. Introduction

Wheat has been cultivated and used for various food products across the world for thousands of years [1, 2]. Wheat flour, which is obtained by grinding wheat grains, serves as a crucial ingredient in many food products such as bread, pasta, and other specific products [3 - 6]. Apart from starch, wheat flour contains other essential components such as gluten, non-starch polysaccharides, and lipids, which determine the flour's quality and composition, directly affecting the human diet [7, 8]. The size of flour particles is also a crucial factor that affects various physicochemical properties, such as water absorption and pasting properties, and ultimately influences the rheological properties of the dough [9].

In addition to processing techniques, the quality of wheat flour, which is influenced by factors such as wheat variety, climate, growing conditions, and soil chemistry, plays a critical role in determining flour product quality [10 - 12]. Therefore, the milling industry needs to conduct experiments to determine the critical constituents of flour such as protein, wet gluten content, ash, moisture content, etc. as these ingredients dictate the intended use of flour [13].

In Kosovo, grain occupies more than half of the arable land, and areas cultivated with wheat have the highest share, annually between 70,000 to 90,000 hectares of winter wheat are cultivated, with an average yield of 2,500 - 3,000 kg x ha^{-1}. However, despite national production, Kosovo cannot attain self-sufficiency as the quantity of wheat harvested is insufficient to meet the demands for human consumption, thereby necessitating the importation of wheat [14]. Similar research on the composition of food products has been carried out in the past in our country [15 - 17].

The quality of flour is determined by its mineral content and physicochemical properties, which can vary depending on the source of the flour. In this context, the characterization of local and imported flour based on their mineral content and some physicochemical parameters is an important research area that has implications for food quality and safety.

This study aims to investigate the mineral content and physicochemical properties of local and imported flour, to understand the differences between them, and to provide insights into their nutritional and functional properties. The results of this study could have significant implications for the food industry and public health.

2. Materials and Methods

2.1 Materials

During December 2022 and January 2023, a research study was conducted to collect flour samples from different markets in major cities across Kosovo. The purpose of the study was to examine the origin of the flour, whether it was locally sourced or imported. In total, twenty samples of flour were collected by the researchers for further analysis and evaluation. The selection of the samples was carried out systematically, ensuring that a representative sample of the available flour products was obtained from each of the selected markets. The samples were carefully handled and transported to the laboratory for further processing and analysis.

2.2 Methods

2.2.1. Determination of moisture content

The moisture content was determined by drying 4 - 5 g of the sample in an apparatus MB 90 at 130 ^{0}C for 60 minutes according to the method AOAC 925.10 [26].

2.2.2. Determination of free acidity

Free acidity was determined by the titrimetric method. This method is based on the titration of the honey sample (10 g diluted with 75 mL distilled water), with 0.1 N sodium hydroxide in the presence of phenolphthalein as an indicator.

2.2.3. Determination of fat

Crude fat was determined by acid hydrolysis of the sample with HCl (25 + 11) followed by extraction of the hydrolyzed lipids with mixed ethers. The ethers are evaporated, and the lipid residue is heated to constant weight at 100°. The residue is expressed as % crude fat, according to the method AOAC 925.12 [27].

2.2.4. Determination of proteins

Protein content was determined by using the Kjeldahl method, which includes digestion with acid, distillation, and titration according to the AOAC 969.37 method [28], using Kjeldahl Apparatus, (FOSS Kjeltec 8420 autosampler systems).

2.2.5. Determination of ash

Ash which presents the mineral content in honey samples, was determined by taking about 10 g honey sample, after the addition of 10 mL warm distilled water, evaporation (100 - 300 ^{0}C), ashing in an electrical furnace (Protherm) at 550 ^{0}C until ashing complete, according to the method AOAC 969.36 [29].

2.2.6. Determination of cellulose

The determination was based on the decomposition of organic matter other than cellulose with an acid solution (acetic acid-nitric acid) and weighing the filtered and dried cellulose.

2.2.7. Determination of gluten and starch

Approximately two Infratec standard flour cups were filled for each lot and placed in a Foss Infratec 1241 grain analyzer. Ten NIT spectra at 850 - 1,048 nm for 2 nm each were recorded and averaged. Dry matter starch content and wet gluten content were automatically calculated based on the integrated Foss global calibration.

2.2.8 Digestion and chemical analysis

The flour samples were digested in a microwave digestion system. In a Teflon tube (PTFE), 0.5 g of flour was weighed, to which 9 ml of HNO_3 (69% V/V, ultrapure) and 1 mL of H_2O_2 p.a. (30% V/V) were added. The Teflon tube was then placed in the microwave (Milestone Ethos Lean) to be decomposed according to the following procedure: From 0 - 160 ^{0}C for 10 min, then for 5 min at constant temperature (160 ^{0}C); then 160 - 200 ^{0}C for 1 min, continuing for 10 min at constant temperature (200 ^{0}C); then the cooling phase took place for 20 min at 50 ^{0}C. The decomposed sample solution was then diluted with redistilled water in a 50 mL volumetric plastic container and sent for analysis [18, 19].

The chemical analyses and the determination of the 9 elements were performed in the laboratory of the Institute of Agriculture, Pejë, Republic of Kosovo. Using the microwave plasma atomic emission spectroscopy (MP-AES) technique model 4200 Agilent Technologies, CA, US), the concentrations of the following elements were determined: Ca, Cu, Fe, K, Mg, Mn, Na, P, and Zn.

2.3 Statistical analysis

Data were analyzed by using the Statistical Package for the Social Sciences (SPSS, 19); descriptive analyses were conducted for variables as well an Independent Sample t-test was used to compare the quantified variables in the samples of flour. The significance was calculated for $P < 0.05$. We found a similar analysis regarding determining the levels of micro minerals in cereals [20], and also in the physico-chemical properties of honey (Rysha *et al.*, [21]). To determine the effect size (Cohen's d) was also analyzed using the following threshold: a small effect size (d = 0.2), a medium effect size (d = 0.5), and a large effect size (d = 0.8).

3. Results and Discussion

3.1 Physicochemical analysis

3.1.1 Descriptive analysis

Concerning the physicochemical properties of flour samples (n = 20), the results (Table 1) showed that the mean for moisture was 13.22 ± 1.20, and the minimum and maximum of detected moisture on samples varied from 10.80 to 14.70.

The aspect of acidity the mean was 1.60 ± 0.27 while the minimum and maximum found was 1.20-2.40. As for fat 1.50 ± 0.12, 1.20 - 1.70 was the minimum and maximum of fat in the total sample. While for containing protein the mean was 11.15 ± 0.93, and the minimum and maximum found in the sample found between 9.97 and 13.00.

Coming to the starch as the next parameter, results showed that the mean was 65.92 ± 2.63, while the minimum and maximum starch found varied from 60.5 to 68.70. As for cellulose content, the mean was 3.06 ± 0.30, characterized by minimum content on samples 2.40 and a maximum of 3.50. Moreover, the mean for gluten content was 28.43 ± 2.02, while the maximum and minimum detected on samples varied from 25.00 to 35.10. While the last physical parameter was Ash, the mean on samples was 0.53 ± 0.16, and the minimum and maximum on samples varied 0.40 - 1.14.

3.1.2 Comparative analysis

3.1.2.1 Moisture (%)

In the present study, the moisture contents of the examined flour samples were 13.61 ± 0.90 for local flour, and 2.83 ± 1.19 for imported flour respectively (Table 1). Based on the results (Table 2) no significant differences were observed when comparing the moisture content of two groups of flour ($P > 0.05$).

3.1.2.2 Acidity (Sh^0)

The results indicated that there were no significant differences between examined samples ($P > 0.05$) for acidity contents (Table 2). The acidity content of the examined flour samples was 1.51 ± 0.19 and 1.69 ± 0.31 for local and imported flour, respectively.

3.1.2.3 Fat (%)

Furthermore, the fat content of flour samples from 1.43 ± 0.13 for local flour to 1.57 ± 0.08 for imported flour (Table 1). Based on the results, there were significant differences between the two groups concerning their fat content ($P < 0.05$). The results imply that imported flour showed the highest fat content with a large effect size ($\bar{x}_{LF.}$ = 1.43, $\bar{x}_{IF.}$ = 1.57, t =-.5.73, p =.000, *d* = 1.297), while the lowest value of fat was seen in local flour. Slightly higher values were shown in the following flour samples; IF 9 Macedonia (1.7%), IF 1;3;4 Serbia

Table 1. Descriptive analysis of physicochemical properties of flour (n = 20)

Parameters	Local flour in Kosovo (n = 10)		Imported flour in Kosovo (n = 10)		Pulled (n = 20)	
	x ± σ	Min-Max	x ± σ	Min-Max	x ± σ	Min-max
Moisture (%)	13.61 ± 0.90	12.30 - 14.70	12.83 ± 1.19	14.40 - 10.80	13.22 ± 1.20	10.80 - 14.70
Acidity (SH^0)	1.51 ± 0.19	1.20 - 1.80	1.69 ± 0.31	2.40 - 1.20	1.60 ± 0.27	1.20 - 2.40
Fat (%)	1.43 ± 0.13	1.20 - 1.60	1.57 ± 0.08	1.70 - 1.40	1.50 ± 0.12	1.20 - 1.70
Protein (%)	10.42 ± 0.42	9.74 - 11.00	11.88 ± 0.68	13.00 - 10.70	11.15 ± 0.93	9.97 - 13.00
Starch (%)	67.43 ± 0.83	66.30 - 68.70	64.42 ± 2.98	68.50 - 60.50	65.92 ± 2.63	60.5 - 68.70
Cellulose (%)	2.97 ± 0.34	2.403.50	3.15 ± 0.24	3.40 - 2.80	3.06 ± 0.30	2.40 - 3.50
Gluten (%)	28.07 ± 0.84	26.6029.40	28.79 ± 2.76	35.10 - 25.00	28.43 ± 2.02	25.00 - 35.10
Ash (%)	0.46 ± 0.05	0.40 - 0.53	0.59 ± 0.20	1.14 - 0.45	0.53 ± 0.16	0.40 - 1.14

(1.6%), IF 5;6 Italy (1.6%), IF 7 Hungary (1.6%) and IF 8 Austria (1.6%) (Figure 1a).

3.1.2.4 Protein (%)

The protein content of flour samples ranged from 10.42 ± 0.42 for local flour to 11.88 ± 0.68 for imported flour (Table 1). However, there were significant differences between flour concerning their protein content ($P < 0.05$). Imported flour showed the highest protein content, while the lowest value of protein content was registered in Kosovo flour ($\bar{x}_{LF.} = 10.42$, $\bar{x}_{IF.} = 11.88$, t = -2.81, p = .011, $d = 2.583$), characterized by larger effect size. The highest protein values were observed in the following imported flour samples such as IF7 Hungary (13%), IF1 Serbia (12.8%), and IF10 Macedonia (12.2%) (Figure 1b).

3.1.2.5 Starch (%)

The starch content of flour samples line from 67.43 ± 0.83 for local flour to 64.42 ± 2.98 for imported flour (Table 1). Results demonstrated there were significant differences between groups regarding their starch content ($P < 0.05$). Results entail, that local flour has significantly higher starch content, while the imported flour enrolled the lowest contain ($\bar{x}_{LF.} = 67.43$, $\bar{x}_{IF.} = 64.42$, t = 3.06, p = .011, $d = 1.376$), characterized by a larger effect size. The highest values of starch observed in local flour samples were in LF 2 (68.4%), LF4 (68.4%), and LF1 (68.3%) in Kosovo flours (Figure 1c).

3.1.2.6 Cellulose (%)

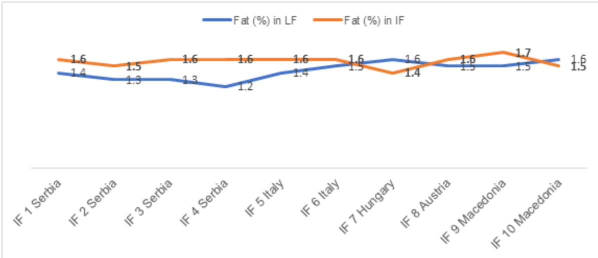
Moreover, the cellulose contents of the examined flour samples were 2.97 ± 0.34 for local flour and 3.15 ± 0.24 for imported flour respectively (Table 1). No significant differences were observed when comparing the moisture content of two groups of flour ($P > 0.05$).

3.1.2.7 Gluten (%)

As for the gluten content, the results indicated that there were no significant differences between the examined groups ($P > 0.05$) (Table 2). The gluten content of the examined flour samples was 28.07 ± 0.84 for local flour and 28.79 ± 2.76 for imported flour, respectively.

3.1.2.8 Ash (%)

The ash content of the examined flour samples was 0.46 ± 0.05 for local flour and 0.59 ± 0.20 for imported flour respectively (Table 1). No significant differences were observed when comparing the Ash content two groups on flour ($P > 0.05$).



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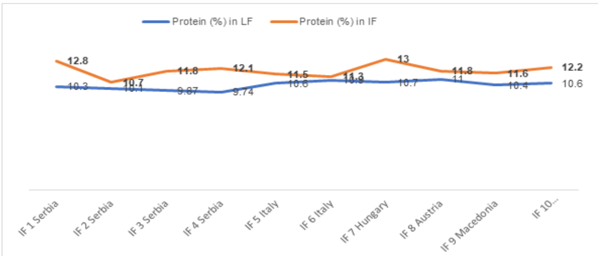

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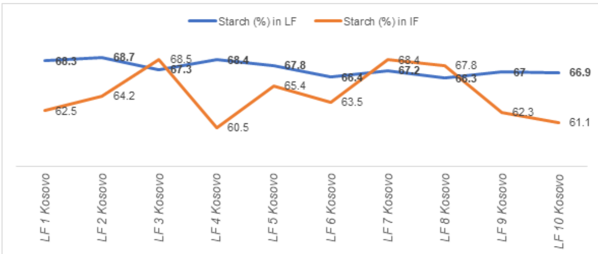

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Figure 1. Summary of the values shown for fat, protein, and starch in LF and IF

Table 2. Comparative analysis for physicochemical properties between LF and IF

Parameters	Local flour	Imported flour				
	Mean	Mean	Mean Difference	T-value	Sig.	d-value
Moisture (%)	13.61	12.83	.780	1.64	.117	0.739
Acidity (SH⁰)	1.51	1.69	-.180	-1.53	.142	0.700
Fat (%)	1.43	1.57	-.140	-2.81	.011	1.297
Protein (%)	10.42	11.88	-1.45	-.5.73	.000	2.583
Starch (%)	67.43	64.42	3.01	3.06	.011	1.376
Cellulose (%)	2.97	3.15	-.180	-1.34	.195	0.577
Gluten (%)	28.07	28.79	-.720	-.787	.441	0.352
Ash (%)	0.46	0.59	-.135	-1.98	.062	0.891

3.2 Mineral content

3.2.1 Descriptive analysis

Table 3 provides a list of the chemical components of flour. The calcium average for all tested sample samples was 140.61 56.32 (mg/kg) of flour, with maximum and minimum values of 59.50 238.90 (mg/kg), respectively. The potassium content ranged from 295.90 (mg/kg) to 971.10 (mg/kg), with a mean of 560.71202.90. The minimum and greatest amounts of magnesium identified in samples ranged from 55.40 to 469.12 mg/kg, whereas sample magnesium content ranged on average from 169.69 to 88.14 mg/kg. The sodium ranged from a minimum of 16.40 mg/kg to a maximum of 94.60 mg/kg. The overall sodium mean was 59.1424.67.

Also, the sample's results revealed that the mean phosphorus content for all samples was 689.93150.70 mg/kg, with a range of 413.60 mg/kg to 943.30 mg/kg. In the two groups, the average iron content of the flour was 9.824.61 mg/kg, with the range of concentrations in all tested flour samples being 4.88 - 25.86 mg/kg. The samples' obtained manganese concentration was 8.31 2.45 mg/kg, and the manganese content ranged from 5.12 to 13.50 mg/kg. Overall, the zinc concentration achieved had a mean of 6.01 1.70 mg/kg, with a range of 3.12 to 9.12 mg/kg at the low end.

Compared to other elements, copper concentration was within a narrow mean of 2.40 ± 1.60 mg/kg, the minimum and maximum found on samples ranged from 0.58 to 6.07 mg/kg. Our findings are in good agreement with reported cereal literature values between 1.8 and 11 mg/kg [20, and 22 - 24].

3.2.2 Comparative analysis

<u>3.2.2.1 Calcium (mg/kg)</u>

Concerning chemical elements, calcium concentrations show high variations between the two groups of samples, the line from 98.73 ± 38.26 (mg/kg) for local flour to 182.50 ± 36.51 (mg/kg) for imported flour (Table 3). Results reveal there were significantly higher differences between groups regarding their calcium concentration ($P < 0.05$). Results in Table 4 imply that imported flour has significantly higher calcium content characterized by a larger effect size, while the local flour enrolled the lowest contain ($\bar{x}_{LF.}$ = 98.73, $\bar{x}_{IF.}$ = 182.50, t = 17.96, p = .000, *d* = 2.24). The highest calcium content (238.9 mg/kg) was shown (Figure 2a) in the imported flour sample IF1 from Serbia, followed by IF9 Macedonia (222.7 mg/kg) and IF7 Hungary (219 mg/kg).

<u>3.2.2.2 Potassium (mg/kg).</u>

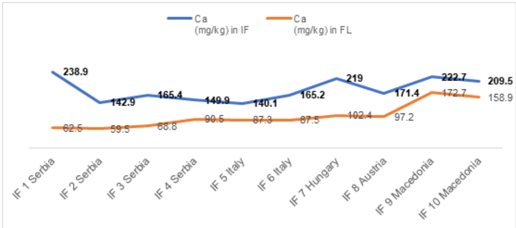
The concentration of potassium in flour samples ranged from 435.43 ± 139.86 mg/kg for local flour to 686.00 ± 180.21 mg/kg for imported flour (Table 3). Furthermore, the potassium content of flour samples listed in Table 4 showed highly significant differences between examined samples ($P < 0.05$). Imported flour showed the highest potassium content characterized by a larger effect size, while the lowest value of protein content was registered in Kosovo flour ($\bar{x}_{LF.}$ = 10.42, $\bar{x}_{IF.}$ = 11.88, t = -2.81, p = .011, *d* = 1.55). The higher values detected on potassium concertation were in IF3 Serbia (971.1 mg/kg), IF6 Italy (866.6 mg/kg), and IF9 Macedonia (688 mg/kg) (Figure 2b).

<u>3.2.2.3 Magnesium (mg/kg)</u>

Moreover, the magnesium content of flour samples from 129.04 ± 63.67 mg/kg for local flour to 210.34 ± 93.14 mg/kg for imported flour (Table 1). Based on the results, there were significant differences between examined samples concerning their fat content ($P < 0.05$). The results imply that imported flour showed the highest magnesium content with a large effect size ($\bar{x}_{LF.}$ = 129.04, $\bar{x}_{IF.}$ = 210.34, t = -2.27, p = .037, *d* = 1.01), while the lowest value of magnesium was detected in local flour. The highest value was observed in sample IF1 Serbia (469.12 mg/kg) followed by IF3 Serbia (215.24mg/kg) and IF8 Austria (195.5mg/kg) (Figure 2c).

Table 3. Descriptive analysis of chemical elements on flour (n=20)

Parameters	Local flour in Kosovo (n = 10)		Imported flour (n = 10)		Pulled (n = 20)	
	x ± σ	Min-max	x ± σ	Min-max	x ± σ	Min-max
Ca(mg/kg)	98.73 ± 38.26	59.50-172.70	182.50 ± 36.51	140.10-238.90	140.61 ± 56.32	59.50-238.90
K (mg/kg)	435.43 ± 139.86	295.90-621.50	686.00 ± 180.21	357.60-971.10	560.71 ± 202.90	295.90-971.10
Mg (mg/kg)	129.04 ± 63.67	55.40-234.10	210.34 ± 93.14	144.40-469.12	169.69 ± 88.14	55.40-469.12
Na (mg/kg)	62.97 ± 24.02	31.10-90.70	55.31 ± 25.98	16.40-94.60	59.14 ± 24.67	16.40-94.60
P (mg/kg)	635.96 ± 188.16	413.60-943.30	743.90 ± 77.89	582.00-823.70	689.93 ± 150.70	413.60-943.30
Fe (mg/kg)	8.26 ± 2.72	5.17-12.80	11.38 ± 5.66	4.88-25.86	9.82 ± 4.61	4.88-25.86
Mn (mg/kg)	8.62 ± 2.97	5.29-13.50	8.01 ± 1.91	5.12-11.60	8.31 ± 2.45	5.12-13.50
Zn (mg/kg)	5.46 ± 2.09	3.12-9.12	6.56 ± 1.02	5.55-8.82	6.01 ± 1.70	3.12-9.12
Cu (mg/kg)	1.38 ± 0.58	0.58-2.31	3.42 ± 1.66	0.99-6.07	2.40 ± 1.60	0.58-6.07



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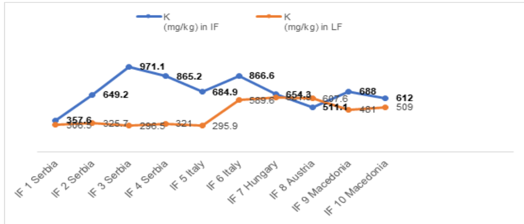

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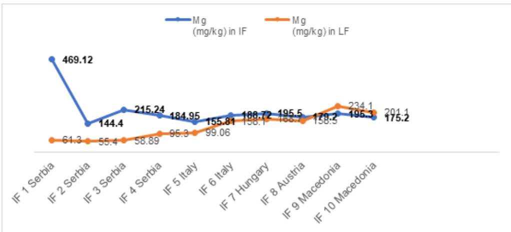

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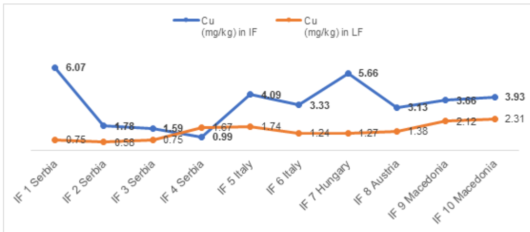

(d)

Figure 2. Summary of the values shown for Ca, K, Mg, and Cu in LF and IF

3.2.2.4 Sodium (mg/kg)

Obtained sodium concentration ranged from 62.97 ± 24.02 mg/kg and 55.31 ± 25.98 mg/kg for local and imported flour, respectively. The results indicated that there were no significant differences between examined samples (*P* > 0.05) for sodium content (Table 4).

3.2.2.5 Phosphorus (mg/kg)

Furthermore, the phosphorus contents of the examined flour samples were 635.96 ± 188.16 mg/kg for local flour and 743.90 ± 77.89 mg/kg for imported flour respectively (Table 3). No significant differences were observed when comparing the phosphorus content of two groups of flour (*P* > 0.05).

3.2.2.6 Iron (mg/kg)

In studied flour samples, the iron ranged from the lowest for local flour at 8.26 ± 2.72 mg/kg and the highest value was registered in imported flour at 11.38 ± 5.66 mg/kg. Based on the result (Table 4) there are no significant differences in iron content noted between all studies groups of flour (*P* > 0.05).

3.2.2.7 Manganese (mg/kg)

The manganese value of twenty flour samples was measured and the obtained results confirmed that the mean for local flour ranged from 8.62 ± 2.97 mg/kg, while for imported flour was 8.01 ± 1.91 mg/kg. There was no significant difference recorded between the two groups of flour concerning manganese content (*P* > 0.05). Manganese concentrations in cereals were reported to range from 32 mg/kg in wheat to 144.00 mg/kg in wheat bran [20, 25]. Generally, the data reported in this study differ from the range found in the literature.

3.2.2.8 Zinc (mg/kg)

In the present study, the local flour samples showed the lowest 5.46 ± 2.09 mg/kg zinc content, on the other hand, imported flour samples had a higher 6.56

Table 4. Comparative analysis for chemical elements among LF and IF

Parameters	Local flour	Imported flour				
	Mean	Mean	Mean Difference	T-value	Sig.	d-value
Ca (mg/kg)	98.73	182.50	-83.77	17.96	.000	2.24
K (mg/kg)	435.43	686.00	-250.57	-3.47	.003	1.55
Mg (mg/kg)	129.04	210.34	-81.29	-2.27	.037	1.01
Na (mg/kg)	62.97	55.31	7.66	.684	.502	0.30
P (mg/kg)	635.96	743.90	-107.93	-1.67	.120	0.74
Fe (mg/kg)	8.26	11.38	-3.12	-1.57	.141	0.70
Mn (mg/kg)	8.61	8.01	.599	.536	.600	0.24
Zn (mg/kg)	5.46	6.56	-1.10	-1.50	157	0.66
Cu (mg/kg)	1.38	3.42	-2.04	-3.66	.002	1.64

± 1.02 mg/kg zinc content. There was no significant difference remarked between samples in zinc content ($P > 0.05$).

3.2.2.9 Copper (mg/kg)

Coming to the copper, the local flour samples showed the lowest 1.38 ± 0.58 mg/kg while the imported flour samples had a higher 3.42 ± 1.66 mg/kg copper content. The results indicated that there were significant differences between examined samples ($P < 0.05$) for copper content (Table 4). Imported flour showed the highest copper content characterized by a larger effect size, while the lowest value of copper content was registered in local flour ($\bar{x}_{LF.} = 1.38$, $\bar{x}_{IF.} = 3.42$, $t = -3.66$, $p = .002$, $d = 1.64$). In this study, imported flour includes the highest value of copper IF1 Serbia (6.07mg/kg), IF7 Hungary (5.66 mg/kg), and IF5 Italy (4.09 mg/kg) (Figure 2d).

4. Conclusions

- In conclusion, the characterization of local and imported flour based on their mineral content and physicochemical parameters is an important research area that has implications for food quality and safety.
- The available evidence suggests that local and imported flour can differ significantly in terms of their mineral content and physicochemical properties. Specifically, the imported flour samples had significantly higher fat and protein content, while the local flour had higher starch content. In terms of macroelement content, the imported flour samples had higher amounts of calcium, potassium, magnesium, and copper than the local flour samples.
- However, further research is needed to better understand the factors that contribute to these differences and to identify the implications for the functional properties of flour in food products. These findings have important implications for consumers, manufacturers, and policymakers regarding the use and purchase of different types of flour in Kosovo.

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