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ACE INHIBITOR ACTIVITY AND ANTIOXIDANT ACTIVITY OF MOUNTAINOUS AND PLAIN EWE'S MILK CHEESES AND THE INFLUENCE OF DIFFERENT HERBS ON THE VOLATILE COMPOUNDS

Erhan I. Sulejmani
University of Tetova, Department of Food Technology, Tetovo, R. North Macedonia

Abstract

This study aimed to investigate the comparison of mountainous and plain areas on the composition, angiotensin-converting enzyme inhibitor (ACE-I) activity, peptide profile and antioxidant activity of Macedonian traditional cheeses. In this study, white brined and beaten cheese, were produced from ewe's milk from mountain (MW, MB) and plain areas (PW, PB) in almost the same traditional manufacturing steps. The cheeses (MW, MB, PW, PB) have been analysed for antioxidant activity and ACE-I activity after 60 days of ripening. The levels of antioxidant and ACE-i activity between the cheeses were found to be the lowest with 98.2 and 82.8 % in the plain white cheese (PW) and highest with 107.6 and 95.5% in mountain white cheeses (MW), respectively.

MATERIALS

A three-gram portion of each sample was placed in a 15-mL vial, and then 10 µL of internal standard containing *100 ppm 2-methyl-3-heptanone, 300 ppm 2-methyl-1-pentanoic acid and 278 ppm ethyl heptanoate in methanol* (Sigma-Aldrich Co., St. Louis, MO, USA) was added to the vial and the mixture allowed to equilibrate at 40 °C for 30 min

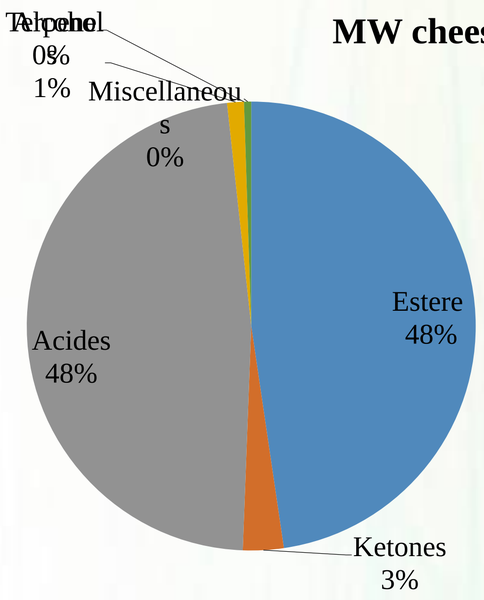
METHODS

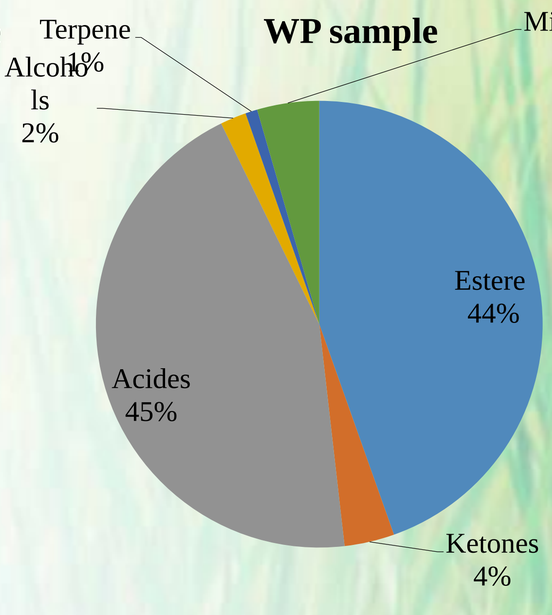
Micro extraction of volatiles aromatic components with GC-MS/ HS-SPME system Shimadzu QP-2010

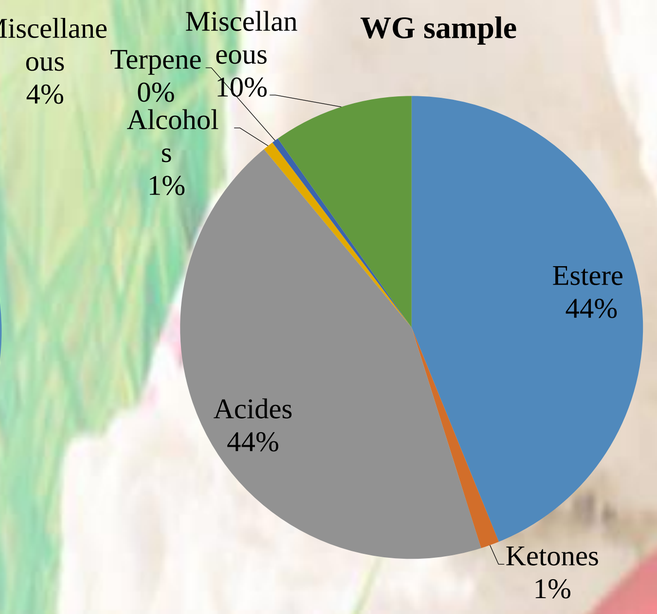
The second part of this study compared the volatile profiles during ripening of white cheese (MW) and herbs containing cheeses (*Mentha longifolia* - WM, *Alium sativum* - WG, *Petroselinum crispum* - WP), made by using ewes' milk. The profiles of volatile compounds of cheeses were analyzed by GC/MS using a solid-phase microextraction (SPME). In the volatile fraction of the herbal cheeses, the volatile components consisted of 7 ketones, 9 acids, 16 esters, 19 alcohols, 8 hydrocarbons, 16 terpenes, 5 aldehydes and 11 others. The main chemical class among the herbal cheeses was acids and esters (68 % and 18 % w/w of all volatile components, respectively). A significantly ($P<0.05$) higher concentration of the volatile compounds was found in the White cheese with Garlic and White cheese with Menta with 41 % and 27 % of total volatile compounds, respectively. These differences in the volatile profiles of cheeses can be explained by the differences in raw materials, spices and production conditions.

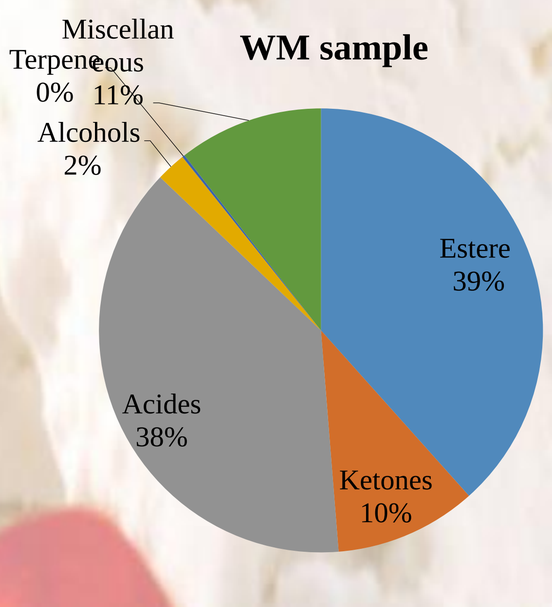
RESULTS AND DISCUSSION

Percentage of distribution of the volatile composition









Main volatile aromatic compounds in cheeses produced with herbs

Acides	***MW***	***WM***	***WP***	***WG***
Propiolic acid	NDa	9±2a	6±2a	NDa
Acetic acid	175±40^{abc}	600±249^{cd}	545±190^{bcd}	781±362^{d}
2-methyl propanoic acid.	7±1ab	24±11ab	19±6.7ab	34±13^{b}
Butanoic acid	89±23^{a}	405±199a	377±152^{a}	648±324^{a}
Pentanoic acid	18±3a	59±36a	53±22^{a}	NDa
Iso-Valeric Acid	NDa	ND a	NDa	62±30^{b}
Hexanoic acid	136±47a	691±41^{abcd}	635±264^{abcd}	1021±55^{bcd}
Octanoic Acid	39±22a	184±129a	187±98a	301±183a
Capric acid	13±10a	68±53a	76±41a	130±94a
Total	***480***	***2043***	***1901***	***2981***

Ketones	***MW***	***WM***	***WP***	***WG***
2-Propanone	3.3±0.5^{a}	3.6±0.1ab	3.3±0.3ab	6.1±2.1d
2.3-Butanedione	ND^{a}	ND^{a}	ND^{a}	ND^{a}
2-Pentanone	3.31±0.3a	2.5±0.2a	ND^{a}	ND^{a}
2-Heptanone	4.21±5.9a	4.9±5.7a	ND^{a}	11.4±3.70a
2-Octanone	0.11±0.1^{a}	ND^{a}	ND^{a}	ND^{a}
3-Hydroxy -2-butanone	3.71±0.7^{abc}	4.4±1.5^{abc}	3.4±2.05^{abc}	5.5±1.9^{abc}
6-Methyl-5-heptenone	NDa	ND^{a}	ND^{a}	ND^{a}
2-Nonanone	2.2±0.3^{ab}	ND^{a}	18.8±21.^{abc}	5.2±1.9^{ab}
8-Nonen-2-one	ND^{a}	ND^{a}	ND^{a}	ND^{a}
2-Undecanone	ND^{a}	ND^{a}	ND^{a}	ND^{a}
2-methyl hexanone	NDa	105±36b	NDa	NDa
Total	***17***	***110***	***25***	***28***

Estere	***MW***	***WM***	***WP***	***WG***
Methyl Acetate	1.09±0.3ab	0.87±1ab	1±0.ab	5.9±3.3c
Ethyl Acetate	45±12.01bc	73±16c	45±5bc	157±24.1d
Methyl butyrate	2±0a	7±2a	4±0.9a	13±8.11a
3 ethyl ester butanoic acid.	NDa	NDa	NDa	NDa
Ethyl butyrate	36±5.7a	75±19bc	41±2ab	107±39c
n-Butyl acetate	4.3±0.5a	7±2ab	4.2±1a	25±0.9c
Isoamyl acetate	1.1±0.05^{ab}	3±0.9^{de}	0.7±1.8^{b}	5±1^{e}
Ethyl n-valerate	0.6±0.1b	NDa	NDa	NDa
Ethyl capronate	13±0.2a	23±33a	23±3a	162±50b
1-Hexyl acetate	NDa	NDa	NDa	NDa
Methyl trichloroacetate	42.3±1.7a	118±88d	45±3a	65±13.6ab
Ethyl trichloroacetate	7.1±0.4a	17±13b	6±0.2a	7±0.8ab
Methyl octanoate	NDa	NDa	NDa	NDa
Ethyl octanoate	1±0a	10±5a	0.0±0.0a	64±18b
Methyl caprate	0.36±0.51a	NDa	NDa	NDa
Ethyl decanoate	0.00±0.00a	3±2a	0.78±1a	15±10b
Ethyl phthalate	26±1a	65±93a	40±5a	226±161b
Total	***277***	***408***	***308***	***948***

CONCLUSION

Consumers are more aware about the relationship between their eating habits and nutritional status. Currently, they have interest in maintaining good health; therefore, they have become more careful in the food they choose to consume, looking for food with a high nutritional value, bioactive compounds and antioxidant capacity.

This is an opportunity for some companies to manufactured food products with the partial or total replacement of those chemical additives by natural herbal.

Acknowledgments

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Reference

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erhan.sulejmani@unite.edu.mk