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Functional drinks and phytopharmaceuticals based on beer and medicinal herbs

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SUMMARY

Beer and medicinal herbs traditionally used in folk medicine can serve as basis for developing a wide variety of products with specific physiological activity. Depending on the nature and content of active ingredients, these products can be classified as either functional beverages or phytopharmaceuticals. The study gives an overview of the potential of different medicinal herbs to serve as sources of active ingredients for functional drinks and beer-based phytopharmaceuticals. It deals with the sensorial evaluation of the final products, determination of the bioactive substance content, potential therapeutic actions, and the recommended dosages.

INTRODUCTION

Beer and herbs have been closely related throughout their history. In the earliest societies, beer was made from local plants and herbs. For ages, herbs were used for flavouring, to cover defects and to make the beverage more attractive. Some of them had medical properties and promoting effect to the body, but nevertheless, like all the others were mostly forgotten and substituted by hop. Today only some of them are still present in brewing but generally as part of the balance of some traditional beers. They can offer much more, especially herbs traditionally used for health purposes. Beer is a truly natural drink. If consumed moderately it evidently has a health promoting effect and as such is an excellent medium for developing a variety of different phytotherapeutic and functional products based on medicinal herbs.

During the past decades, public interest in natural therapies, namely herbal medicine, has increased dramatically in both developing and developed countries. The reasons are numerous. Most of the herbs are now available in the form of standardised extracts permitting reproducibility of therapeutic effects. Because of their multiplicity of active constituents, they bind to multiple receptor sites in the body and in total produce a significant beneficial physiological effect with minimum side effects. This

special attention. Anethole has been shown to block both inflammation and carcinogenesis in some kind of tumor cells (16-19).

Linden, Tilia, Lime tree flower (*Tillia cordata* Mill.) - faintly aromatic. Native throughout Europe and planted as well. It is used to alleviate irritation of the throat in catarrh of the respiratory tract, and as a diaphoretic in feverish colds and infections for which a sweat cure is desired. In folk medicine it is still occasionally used as a diuretic, stomachic, antispasmodic, and sedative. Extracts of lime tree flower are a component of some prepared urological remedis, antitussives, and sedatives. The drug is a component of various herbal mixtures recommended for chills, cold, etc. (13).

Thyme (*Thymus vulgaris* L.) - native in various subspecies and forms in central and southern Europe, the Balkans; the plant is cultivated in central Europe, East Africa, India, Turkey, Israel, Morocco and North America. Thyme contains 1.2-2.5 % essential oil, tannins, flavonoids, and triterpens. Essential oil contains mainly the isomeric monoterpens thymol. Besides these constituents thyme possesses numerous other compounds phytosterols, triterpenes, flavonoids, saponins, etc. shown to be cancer chemoprotective. Because of that thyme has been identified by the National Cancer Institute as one of the herbs that possess cancer-preventive properties (13, 20).

Thyme is an important culinary herb. In folk medicine, it has been used as a spasmolytic, stomachic, carminative, diuretic, urinary disinfectant, and vermifuge. It has been used primarily because of its essential oil as an expectorant and bronchospasmolytic in acute and chronic bronchitis, whooping cough, and generally in catarrh of the upper respiratory tract.

Oregano, *Origanum vulgare L* - aromatic, warm and slightly bitter. Belongs to the mint family (Lamiaceae) the same as thyme. Native and planted throughout Europe, the Mediterranean region and southern and central Asia. Oregano is an important culinary herb as well. Contains up to 4 % essential oil with variable amounts of carvacrol and thymol and a variety of monoterpene hydrocarbons and monoterpene alcohols.

Oregano is high in antioxidant activity, particularly due to a high content of phenolic acids and flavonoids. It is still used in modern herbal remedies for many ailments. In the Philippines, oregano is not commonly used for cooking but is rather considered as a primarily medicinal plant useful for relieving coughs.

MATERIALS AND METHODS

Raw materials

Herbs tinctures were prepared at the Institute for Medicinal Plant Research Dr. Josif Pančić using the conditions prescribed according to Pharmacopoeia (21). Herbal drugs were cut to pieces of suitable size, mixed thoroughly with a portion of extraction solvent (70 % alcohol, drug: solvent ratio 1:5) and allowed to stand for 24 h. Extraction was done using percolation method in a percolator at room temperature. The residue was pressed out and the expressed liquid combined with the percolate.

Prepared extracts were added aseptically to commercially produced bottled pils, dark and alcohol-free beers taking into account the recommended daily doses and sensory acceptability (22). After injection the bottles were immediately closed and maturated on 5 °C for one day.

Analysis

In addition to basic characteristics (content of dry matter, relative density, refractive index and the content of ethanol), samples of tinctures of lemon balm (*Melissa*

Lemon balm is a herb absolutely compatible with beer, particularly dark beer. Male and female tasters had very similar opinion that up to 1/3 of recommended daily dose (RDD) can be sensory acceptable. The tasted samples flavoured with juniper berry (figure 1) and juniper berry and linden (figure 2) were evaluated as even better than starting standard beer. It is interesting to note that beer abstinents appraised both combinations as "very pleasant and satisfying".

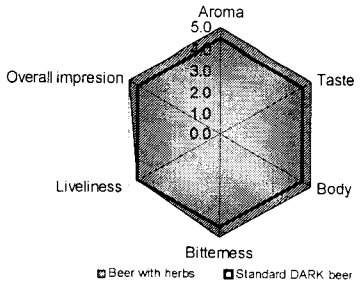

Figure 1: Lemon balm tincture added to standard dark beer in 1/3 RDD and flavored with juniper berry - male and female tasters.

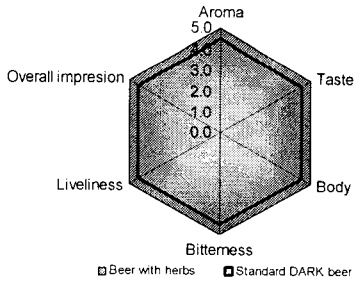

Figure 2: Lemon balm tincture added to standard dark beer in 1/3 RDD and flavoured with juniper berry and linden - male and female tasters.

White birch tincture had favourable pharmacological properties, however the taste was both strong and unpleasantly bitter. Tasters agreed that it is unacceptable as a main ingredient and may be added only in doses smaller that 1/3 RDD and in combination with other herbs.

On the other hand, fennel showed to be a very interesting supplement, the acceptance of which depended strongly on the affinity with regard to the characteristic anis flavour. The opinion of both male and female tasters with respect to this differed. Male tasters considered it quite acceptable even in 1/3 RDD but flavoured with linden, angelica and artichoke. This combination in standard pils and alcohol-free beer was judged even better than starting beer (figure 3). Female tasters showed affinity for less expressive anis flavour and its combination with dark beer. They appraised very good the sample with birch and flavoured with linden (figure 4). All tasters agreed that both combinations had very interesting specific characteristics and can be accepted as aperitif or digestive.
Linden tincture showed similar acceptance properties. Both male and female tasters agreed that it can be added up to 1/3 RDD to dark beer. Male consumers preferred the combination with artichoke (figure 5), while female consumers gave priority to the sample flavoured with angelica and anis (figure 6).

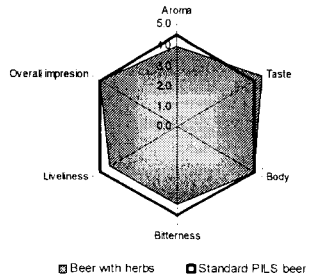

Figure 9: Oregano tincture added to standard pils in 1/3 RDD and flavored with juniper barry and clove - male and female tasters results.

Oregano tincture was accepted by both male and female tasters in a similar way. The overall impression was that in combination with juniper berry and clove, added up to 1/3 RDD to standard pils beer it gives an interesting product (figure 9). It was evaluated somewhat lower than the starting beer, but was described as "pleasant, and Mediterranean like". Tasters agreed that it can be a good combination with Mediterranean food, but most of all an interesting, favourable aperitif or digestive.

Considering the above mentioned it is obvious that the combination of different types of beer and medicinal herbs tinctures in recommended daily doses can give products with satisfactory sensorial properties. Such products should have predictable pharmacodinamic properties and can potentially be recognized as "traditional herbal medicinal products". Its base is beer, fully natural product with tradition longer than 6000 years, evident positive effect on the overall health condition and with presence of alcohol as the only limiting factor. Eliminating alcohol using alcohol-free beer as a base product and/or adequate "suggest use", this problem may be avoided. The problem which is not so easy to solve is legislation of such product (23). Other possible solution is to use medicinal herbs tinctures in lower doses and to produce functional drinks.

CONCLUSIONS

Medicinal herbs with their long tradition in folk medicine and increased public interest in natural therapies give the brewing industry the chance to fulfil several goals: develop novel beer products, develop products with health-promoting properties meeting market needs and eventually gain new beer consumers. The beers obtained using medicinal herbs and herb tinctures as a natural source of nutritional supplements may be sensory very pleasant and even acceptable to beer abstinents. They possess determined pharmacodinamic properties, and may be recognized as "traditional herbal medicinal products" or "functional drinks". The first solution is attractive but requires complicated registration procedure and there is a long way ahead in order to fulfil different criteria, protocols, expertises, directives, etc. The second solution is easier, cheaper, raises consumption without risking overdosage and may be more acceptable from the sensory standpoint.

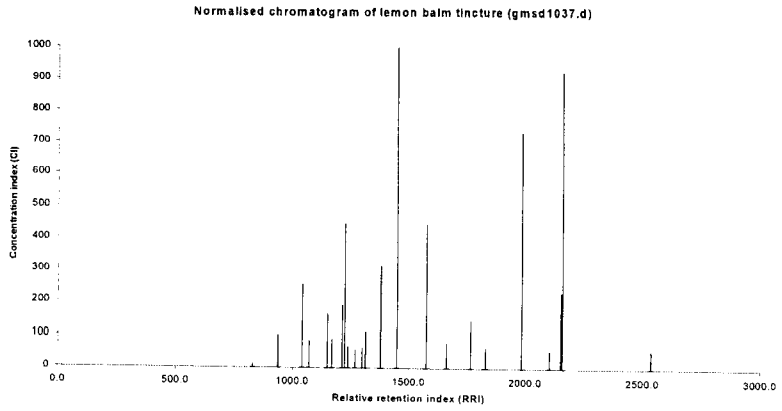

Figure 10: Normalised chromatogram of lemon balm tincture.

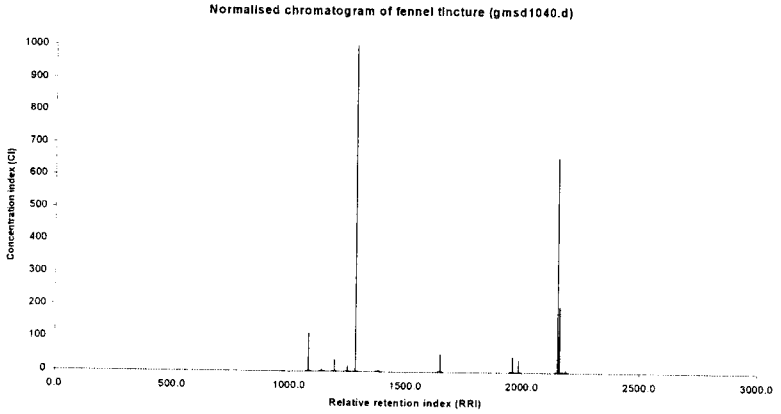

Figure 11: Normalised chromatogram of fennel tincture.

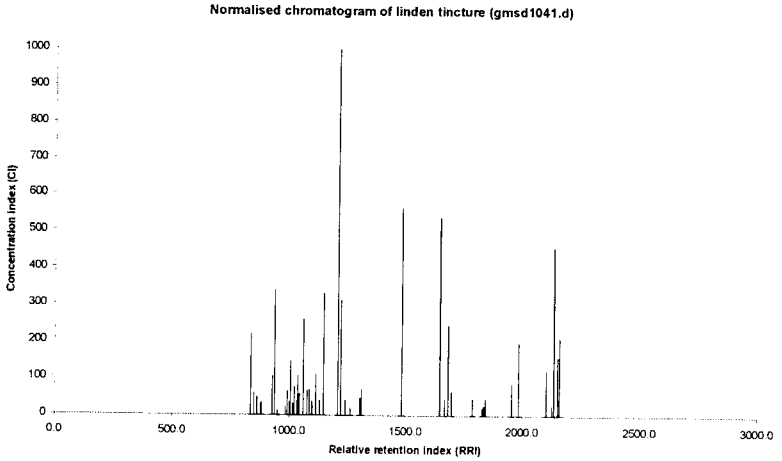

Figure 12: Normalised chromatogram of linden tincture.

Table 2: Relative content of volatile constituents of lemon balm tincture.

Peak	Constituents	RT/MS	% m/m	RRI	CF
1	n.i.*	4.193	0.22	830.4	12
2	2-hydroxycyclopent-2-en-1-one	7.492	1.78	937.7	101
3	phenyl acetaldehyde	10.881	4.48	1041.3	255
4	2-heptanone	11.903	1.53	1071.1	87
5	3,5-dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one	14.619	2.88	1149.3	164
6	menthol	15.309	1.59	1169.0	90
7	pyrocatechol	16.842	3.36	1213.0	192
8	coumaran	17.174	7.87	1223.0	448
9	geranial	17.685	1.17	1238.3	66
10	neral	18.698	1.00	1268.1	57
11	thymol	19.765	1.11	1299.8	63
12	carvacrol	20.123	1.97	1312.5	112
13	geranyl acetate	22.346	5.55	1379.5	316
14	n.i.*	24.543	17.55	1449.8	1000
15	caryophyllene oxide	28.299	7.81	1574.6	445
16	n.i.*	30.800	1.38	1663.6	79
17	n.i.*	33.507	2.53	1765.4	144
18	neophytadiene (isomer II)	35.166	1.13	1829.9	64
19	ethyl palmitate	38.994	12.86	1985.1	732
20	n.i.*	41.710	0.97	2104.5	55
21	ethyl linoleate	42.785	4.07	2153.0	232
22	ethyl linolenate	42.929	16.24	2159.7	925
23	n.i.*	50.656	0.98	2537.0	56

*n.i.=not identified

Table 3: Relative content of volatile constituents of fennel tincture.

Peak	Constituent	RT/MS	%m/m	RRI	CF
1	fenchone	12.296	4.91	1082.5	112
2	camphor	14.259	0.20	1139.0	4
3	estragole	16.150	1.53	1193.0	35
4	cis-anethole	18.015	0.39	1247.9	9
5	p-anisaldehyde	18.123	0.73	1251.1	17
6	trans-anethole	19.234	43.81	1284.3	1000
7	anisylacetone	22.399	0.18	1381.0	4
8	ethyl α-D-glucopyranoside	30.395	2.30	1648.8	52
9	palmitic acid	38.382	1.99	1959.7	46
10	ethyl palmitate	39.010	1.64	1985.7	37
11	oleic acid	42.757	28.74	2152.1	656
12	ethyl linoleate	42.829	4.68	2155.2	107
13	ethyl oleate	42.981	8.66	2162.1	198
14	ethyl stearate	43.528	0.26	2186.7	6

Table 5: Relative content of volatile constituents in thyme tincture.

Peak	Constituents	RT/MS	% m/m	RRI	CI
1	1,3-cyclopentanedion	7.537	0.21	938.8	4
2	trans-sabinenehydrate	11.634	0.93	1063.4	17
3	linalool	12.781	1.61	1096.6	29
4	acetin	13.346	0.84	1115.0	15
5	3,5-dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one	14.547	1.39	1147.2	25
6	borneol	15.031	1.22	1160.9	22
7	pyrocatechol	17.093	10.97	1220.8	198
8	5-hydrxoymethylfurfural	17.694	1.32	1238.3	24
9	n.i.*	18.510	1.51	1262.4	27
10	thymol	19.505	55.43	1292.1	1000
11	carvacrol	19.774	3.48	1300.0	63
12	vinylguaiacol	20.087	2.50	1309.5	45
13	n.i.*	20.419	1.08	1320.0	20
14	syringol	21.369	2.64	1349.4	48
15	eugenol	21.495	2.24	1353.0	40
16	4-ethylresorcinol	22.795	1.40	1393.3	25
17	n.i.*	24.722	6.52	1455.8	118
18	n.i.*	25.475	0.29	1480.3	5
19	thymohydroquinon	25.663	1.50	1486.0	27
20	1-(2,6-dihydroxy-3-methylphenyl)ethanone	27.788	0.66	1557.4	12
21	1-(1-carboxyethyl)-4-(1-formylethyl)benzene	32.055	1.30	1709.7	24
22	n.i.*	32.288	0.97	1718.7	17

*n.i.=not identified

Table 6: Relative content of volatile constituents in oregano tincture.

Peak	Constituents	RT/MS	% m/m	RRI	% CI*
1	1,2-cyclopentanedione	7.446	1.38	935.8	24
2	phenol	9.149	1.82	990.4	31
3	1,8-cineole	10.342	1.14	1025.9	20
4	linalool	12.789	1.05	1096.7	18
5	β-thujone	12.923	1.99	1100.6	34
6	camphor	14.241	3.04	1138.5	52
7	pyrocatechol	16.644	58.44	1207.5	1000
8	coumaran	17.092	4.34	1220.7	74
9	n.i.*	18.499	1.69	1262.2	29
10	n.i.*	24.452	11.91	1447.0	204
11	caryophyllene oxide	28.297	2.13	1574.6	36
12	mannose	30.332	0.18	1646.6	3
13	ethyl palmitate	39.001	4.03	1985.3	69
14	ethyl linoleate	42.784	1.32	2153.0	23
15	ethyl linolenate	42.928	3.87	2159.7	66
16	n.i.*	50.637	1.68	2536.2	29

*n.i.=not identified