



## POLYPHENOL CONTENT AND ANTIOXIDANT ACTIVITY OF COMMERCIAL BEERS FROM THE ROMANIAN MARKET

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**Abstract:** *The aim of this study is to evaluate the polyphenol content and antioxidant activity of 10 different samples from the Romanian market. The samples were purchased from the local market of Suceava town, Suceava county. Polyphenolic compounds are ubiquitous in all plant organs and are, therefore, an integral part of the human diet. They are synthesised by the phenylpropanoid biosynthetic pathway, which produces the large variety of plant phenols. The polyphenol content of the beer samples was measured using the Folin Ciocalteu method. The antioxidant activity of beer samples were measured using the DPPH assay. The two methods were applied using a UV-VIS spectrometer. The 10 beer samples analyzed showed considerable differences between them among total polyphenol content, ranging between 61.40 mg GAE/l for Landbier beer to 361.40 mg GAE/l for Skol beer. All the beer samples showed strong activities of the DPPH radical at the concentration test. The values of PI% are ranged between 10.24 and 33.68%. Tuborg beer showed the highest antioxidant activity, while Landbier showed the smallest one.*

**Keywords:** polyphenol, antioxidant activity, beer

### 1. Introduction

Beer is a natural beverage, with no fat and low caloric content, with organic acids and vitamins, proteins, hop and water. Beer has a higher nutritional value than other alcoholic beverages because of its mineral value and essential nutrients such as potassium, magnesium, calcium and sodium. The use of cereals and malt to produce beer may also contribute for the ingestion of naturally occurring antioxidant compounds, such as polyphenols [1].

Polyphenolic compounds are ubiquitous in all plant organs and are, therefore, an integral part of the human diet. They are synthesised by the phenylpropanoid biosynthetic pathway, which produces the large variety of plant phenols. In the last decades, the interest of polyphenolic compounds was related to the ability of them to bind and precipitate macromolecules (dietary protein, carbohydrate, digestive enzymes), but in the last part of XX century, the interest in food phenolics has increased due to the antioxidant and free radical-scavenging

abilities [2]. Polyphenols may exert an indirect antioxidant effect, by protecting endogenous antioxidant enzymes in the human body [3, 4]. Stevenson & Hurst [3] suggest in their review that it appears that polyphenols can provide significant protection from oxidative stress *in vitro* at concentrations much lower than would be required for chemical antioxidant protection [5].

The antioxidant properties of phenolics is mainly because of their redox properties, which allow them to act as reducing agents, hydro-gen donators and singlet oxygen quenchers [6]. A polyphenol substance can be defined as an antioxidant only if it fulfills two conditions, firstly, when present in low concentration relative to the substrate to be oxidized it can delay, retard or prevent the oxidation or free radical mediated oxidation of a substrate and secondly that the resulting radicals formed after scavenging must be stable [7]. The aim of this study is to evaluate the polyphenol content and antioxidant activity of 10 different samples from the Romanian market.

## 2. Materials and methods

### 2.1. Materials

For this study were purchased 10 different commercial beers from the Romanian Market.

### 2.2. Polyphenols content

#### FolinCiocalteau reagent preparation

Reagents: 7.5%  $\text{Na}_2\text{CO}_3$  solution, Folin Ciocalteau solution 1:10, methanol. 100 g of  $\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$  and 25 g of  $\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$  are dissolved into 700 mL of warmed bidistilled water. 50 mL of 85%

o-phosphoric acid and 100 mL of 37% chlorhidric acid are mixed with the previous substances. The mix is boiled for 10 h. 150 of  $\text{Li}_2\text{SO}_4 \cdot \text{H}_2\text{O}$  and some goats of Br are added, and the boiling is continued for 15 min. The mix is puted into 1 L flask and filled up with bidistilled water. The reagent is kept in dark.

### Beer polyphenol determination

0.2 ml of beer are added into a tube, 2 ml of Folin Ciocalteau 1:10 and 1.8 ml of 7.5 %  $\text{Na}_2\text{CO}_3$  are added. The mixture is agitated and the absorbance in measured at 750 nm using the Ocean Optics HR4000 spetrometer.

Polyphenol calibration curve is made using a known polyphenol (gallic acid) of 1, 2, 3, 4 and 5 mg/L concentration, respectively. The calibration curve is presented into figure 1.

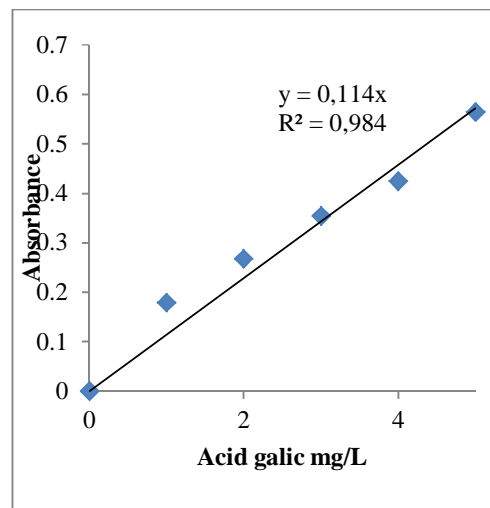


Fig.1. Polyphenol calibration curve

### 2.3. Antioxidant activity

The antioxidant activity was determined using the DPPH assay. The antiradical power determination is made by

comparing with a stable radical, 1,1-difenil-2-picrilhidrazil, DPPH.

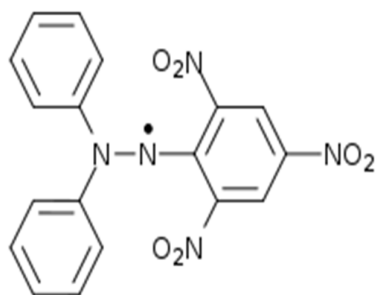


Fig.2 DPPH chemical structure

5  $\mu$ l of beer sample are added into a spectrophotometer cuvette and after it 3 ml of DPPH solution (25 mg/L methanol) are added. The sample is left for 5 min and the absorbance is measured at 517 nm using a Ocean Optics HR4000 UV-VIS spectrometer.

The inhibition power of free radical (PI %) is measured by comparing the DPPH absorbance with the sample absorbance using the equation:

$$PI \% = [1 - (A_{\text{sample}} / A_{\text{blank}})] \times 100.$$

The absorbance for the samples  $A_{\text{sample}}$  were measured at 517 nm, and for  $A_{\text{blank}}$  for the DPPH solution.

## 2.4. Statistical analysis

The statistical analysis was made using the next software packs: Excel 2007. The variables were weighted with the inverse of the standard deviation of all objects in order to compensate for the different scales of the variables.

## 3. Results and discussions

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The polyphenol content of the 10 beer samples were examined using the Folin Ciocalteu method, and the results are presented in table 1. The 10 beer samples analyzed showed considerable differences between them among total polyphenol content, ranging between 61.40 mg GAE/l for Landbier beer to 361.40 mg GAE/l for Skol beer. Guinness, Gauloise and Suceava beers showed a high content of polyphenol (>100 mg GAE/l). The polyphenols play a critical role into the flavor stability and for the colloidal stability too.

**Table 1.**  
**Polyphenol content of beer samples**

No.	Commercial name	Acid galic mg/L
1	Skol	361,40
2	Suceava	107,01
3	Ursus	96,49
4	Timișoareana	94,74
5	Tuborg	68,42
6	Silva brună	78,95
7	Ursus brună	70,18
8	Gauloise	115,79
9	Guinness	131,58
10	Landbier	61,40

The antioxidant activity of the 10 beer samples are presented into the table 2. All the beer samples showed strong activities of the DPPH radical at the concentration test. The values of PI% are rangind between 10.24 and 33.68%. Tuborg beer showed the highest antioxidant activity, while Landbier showed the smallest one. All the results showed that the raw materials and the brewing process have significant influence on the DPPH radical activity of beer samples.

**Table 2.**  
**Antioxidant activity**

No.	Commercial name	PI %
1	Skol	11.29
2	Suceava	13.12
3	Ursus	12.06
4	Timișoareana	17.79
5	Tuborg	33.68
6	Silva brună	13.12
7	Ursus brună	12.61
8	Gauloise	11.16
9	Guinness	21.57
10	Landbier	10.24

#### 4. Conclusions

Phenolic compounds play a critical role into arome stability and in the colloidal stability of beer. The phenolic compounds are considered, in general, the most important source of antioxidants in beer. Even the individuals phenolics responsible for the antioxidant activity of the beer were not determined the general contribution of the phenolic compounds at the antioxidant activity of the beer ranged between 10.24 and 33.68%. The results obtained showed that the raw materials and the brewing process can influence significantly the antioxidant activity. The polyphenol content ranged between 61.40 mg GAE/l for Landbier beer to 361.40 mg GAE/l for Skol beer.

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