presented data, namely recommended dietary allowances, adequate daily dietary intake [28–30], tolerable upper intake level [28,29], and maximum level of daily intake without detriment to health [31], it can be concluded that concentrations of all of them were within safety baseline levels for human consumption. These results indicate that the analysed medicinal herbs, chocolate, and bovine liver are the source of dietary micro-nutrients that should not be neglected. It is clear that examined samples should be considered as trace elements in the diet. This is especially important if we take into account the accumulation of toxic elements and their effects on the human body. However, the observed Zn concentration in bovine liver samples (Tab. 9) was slightly higher than the values recommended by the Polish Ministry of Health [27].

The reason for the abnormal values may be endogenous and external contamination, i.e. resulting from the ‘finger bias’. A slightly higher Pb level than admissible for groceries in Poland [27] was determined in all samples of medicinal herbs. This indicated that the local samples were lead-contaminated due to pollution.

Interestingly, the average concentration of Cd recorded in the samples of medicinal herbs, was higher than that recommended by the Polish Ministry of Health [27], except for samples of bovine liver and chocolate. It should also be emphasized that Cu concentrations in all samples showed lower levels than those recommended by the Polish Ministry of Health. However, the differences in Ni and Mo concentrations did not reach the level of significance compared to values presented in the literature [1,15].

The fact that toxic metals are present in high concentrations in biological samples is of particular importance in relation to FAO/WHO [36] standards for Pb and Cd as toxic metals. The maximum permissible doses for an adult person are 3 mg of Pb and 0.5 mg of Cd per week, but the recommended doses are only one-fifth of those quantities.

The results achieved for heavy metals in all samples were in good agreement with other data reported in the literature.

K. Srogi

OZNACZENIE ZAWARTOŚCI WYBRANYCH METALI CIĘŻKICH W ZIOŁACH, WĄTROBIE I W CZEKOLADZIE Z WYKORZYSTANIEM ABSORPCYJNEJ SPEKTROMETRII ATOMOWEJ

Streszczenie

Oznaczono zawartości metali ciężkich: kadmu, ołowiu, cynku, miedzi, niklu i molibdu metodą absorpcyjnej spektrometrii atomowej (FAAS i ETAAS) w niektórych artykułach spożywczych. Próbki mineralizowano w mieszaninie HNO₃+HClO₄ (2:1 v/v) przy użyciu energii promieniowania mikrofalowego. W ocenie kontroli jakości metodologii postępowania analitycznego wykorzystano dwa certyfikowane materiały odniesienia: CTA–OTL–1 Oriental Tobacco Leaves i NIST 1577a Bovine Liver. Wykazano zadowalającą zgodność uzyskanych wyników z wartościami podanymi w certyfikatach materiałów odniesienia.

<table>
<thead>
<tr>
<th>Element</th>
<th>Recommended value by the Polish Ministry of Health [mg/kg] [27]</th>
<th>Recommended dietary allowances/adequate daily dietary intake [µg/day] [28–30]</th>
<th>Tolerable upper intake level [µg/day] [28,29]</th>
<th>Maximum level of daily intake without detriment to health [mg] [31]</th>
<th>Daily dietary intake [µg/day] [32–35]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cd</td>
<td>0.02</td>
<td>70</td>
<td>—</td>
<td>0.018–0.20</td>
<td>23–120</td>
</tr>
<tr>
<td>Cu</td>
<td>20.0</td>
<td>900</td>
<td>10</td>
<td>3.2</td>
<td>1000–4800</td>
</tr>
<tr>
<td>Pb</td>
<td>1.0</td>
<td>250</td>
<td>—</td>
<td>2.0</td>
<td>34–440</td>
</tr>
<tr>
<td>Ni</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td>0.45</td>
<td>50–799</td>
</tr>
<tr>
<td>Mo</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Zn</td>
<td>50.0</td>
<td>8–11 [mg]</td>
<td>40</td>
<td>17</td>
<td>6800–22 500</td>
</tr>
</tbody>
</table>
Dla wszystkich analizowanych próbek wykazano odpowiednio dla Cd, Cu, Pb, Zn i Mo następujące zakresy stężeń: 0,06–0,49; 0,85–17,78; 0,10–27,32; 3,08–145,19; 0,95–4,01 i 0,07–2,89 mg/kg. Uzyskane wartości stężeń nie odbiegają znacząco od danych przedstawionych w literaturze, dotyczących oznaczania mikroelementów w żywności.

REFERENCES