EFFECTS OF LOCAL BANANA WINE CONSUMPTION ON URIC ACID ELIMINATION:
A QUANTITATIVE ANALYSIS.

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INTRODUCTION

Abnormal levels of uric acid (UA), the principal end product of purine metabolism, are usually associated with several disorders such as gout and Lesch–Nyhan syndrome (Harper, 1977). Gout occurs when sodium urate crystals are deposited in the joints, soft tissue, bursae and tendons (Murray et al. 2011). Lesch–Nyhan syndrome is an X-linked chromosome disorder that results in the absence of the enzyme hypoxanthine–guanosine phosphoribosyltransferase (HGPRT). Hyperuricemia (elevated concentrations of UA) may indicate other medical conditions such as kidney injury (Heptinstall et al. 1966), leukemia (Kraffoff et al. 1965) and pneumonia (Puig and Mateos, 1994 [5]). The determination of the UA is therefore very important. Recently, a sensitive determination of UA has been carried out (Ndamanisha and Guo, 2008).

In Burundi, local alcohol drinks are more consumed because they are produced in almost all the regions of the country and they are cheaper than industrial drinks. It is thus easy to get them easily. However, those drinks have not well analyzed and the association between consumption of them and risk of some diseases is not well known. It has been observed that the drinking of large amounts of ethanol leads to an elevation of serum uric concentration (Lieber et al., 1962; Yamamoto et al., 2005; Yamanaka, 1996; Stibůrková et al. 2014). Moreover, we are experiencing many cases of gout and other diseases related to hyperuricemia in villages where that banana wine is consumed. Few studies showed how uric acid is eliminated in urine after consumption of ethanol.

In the present work, eliminated uric acid after consumption of different volumes of banana wine is determined. Effects of this local drink are then analyzed. This study is important because alcohol intake is strongly associated with an increased risk of gout. However, this risk varies substantially according to the type of alcoholic beverage; beer confers a larger risk than spirits, whereas moderate wine drinking does not increase the risk (Choi et al. 2014).

Keywords: Uric acid, elimination, banana wine, urine.

RESULTS AND DISCUSSION

Banana wine characteristics

The alcohol degree of the prepared wine was 7.4% (V/V). According to this degree, this wine can be classified in strong drinks (Koolman and Rohm, 2004). The wine’s pH was 3.88. This pH is preferred for food because it limits microorganisms in the drink (Negre and Francot, 1965). The characteristics were stable during the experiments because the wine was stored in the refrigerator.

Effects of banana wine consumption on uric acid elimination

It is known that measuring uric acid after drinking should be expressed per g of creatinine in urine in order to correct for dilution errors (Kumi et al. 2015). However, as we are working in the same conditions before and after drinking, effects on uric acid elimination can be studied using concentration of uric acid. Table 1 shows the different concentrations of eliminated uric acid in the urines. It is easy to note that, after drinking 0 cl of banana wine, uric acid concentrations are different from one student to another. This can be
attributed to individual metabolism of purines and uric acid that is different from one student to another (Neuman et al. 2002). Also, one can see that the uric acid concentrations increase after drinking 67.5 cl of banana wine and decrease when the volume of wine taken increases.

**Table (1)** Concentrations of eliminated uric acid in the urine (mg/dl).

<table>
<thead>
<tr>
<th>Student label</th>
<th>Day 1 (before consumption of wine)</th>
<th>Day 2 (after consumption of 67.5 cl)</th>
<th>Day 3 (after consumption of 135 cl)</th>
<th>Day 3 (after consumption of 202.5 cl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>42.43</td>
<td>51.69</td>
<td>27.6</td>
<td>9.99</td>
</tr>
<tr>
<td>B</td>
<td>72</td>
<td>93.92</td>
<td>11.1</td>
<td>25.38</td>
</tr>
<tr>
<td>C</td>
<td>42.63</td>
<td>59.07</td>
<td>35.7</td>
<td>21.23</td>
</tr>
<tr>
<td>D</td>
<td>72.31</td>
<td>94.84</td>
<td>28.2</td>
<td>7.53</td>
</tr>
<tr>
<td>E</td>
<td>24.31</td>
<td>156.23</td>
<td>18.9</td>
<td>35.23</td>
</tr>
<tr>
<td>F</td>
<td>42.31</td>
<td>90.69</td>
<td>32.4</td>
<td>39.53</td>
</tr>
<tr>
<td>G</td>
<td>49.57</td>
<td>64.38</td>
<td>20.7</td>
<td>16.30</td>
</tr>
<tr>
<td>H</td>
<td>41.68</td>
<td>63.24</td>
<td>40.2</td>
<td>18.61</td>
</tr>
<tr>
<td>I</td>
<td>46.15</td>
<td>57.46</td>
<td>33.6</td>
<td>31.38</td>
</tr>
<tr>
<td>J</td>
<td>32.19</td>
<td>54.46</td>
<td>13.2</td>
<td>8.61</td>
</tr>
<tr>
<td>K</td>
<td>36.94</td>
<td>64.61</td>
<td>34.5</td>
<td>31.07</td>
</tr>
<tr>
<td>L</td>
<td>78.09</td>
<td>143</td>
<td>79.84</td>
<td>-</td>
</tr>
</tbody>
</table>

In order to show the variation of the uric acid concentrations in eliminated urines, it is better to use graphics. Except for the student L who was not able to drink 202.5 cl of wine, the results indicate that it is possible to distinguish two cases. In case 1 we have students A, C, D, G, H, I, J and K whereas in case 2 there are students B, E and F.


The behavior of this group is similar apart from the difference in the uric acid concentrations. This can be due to the fact that the catabolism of ethanol is different from one to another (Marshall and Bangert, 2005). Clear figures are obtained if the group is divided in two classes.

Figure (1) and Figure (2) show the variation of uric acid concentrations in urine after consumption of different quantities of banana wine taken by A, C, D, G and H, I, J, K respectively.

After drinking 67.5 cl of wine, all members of the group show an increase in the concentration of uric acid in the urine. It is clear that consumption of this volume of banana wine makes uric acid elimination easier. This easy uric acid elimination can be explained by the benefits of moderate consumption of alcohol (Choi et al. 2004). Therefore, many disorders as gout can be limited with such moderate consumption. The same phenomenon has been observed with diabetes. The risk of diabetes is reduced in moderate alcohol consumers (Landó et al. 2005; Beulens et al. 2005).

This behavior changes when increasing the volume of wine. After taking 135 cl of wine, the uric acid concentrations decrease drastically. It is also easy to figure out that consumption of 202.5 cl of wine results in the same behavior (decrease of the uric acid concentration in urine).

Uric acid is not easily soluble in water and the solubility will decrease with introducing other acids in the medium. The ethanol in the organism is transformed in pyruvic acid and lactic acid according to the following equation:

$$C_2H_5OH \rightarrow CH_3COOH \rightarrow CH_3CHOHCOOH$$

(7, Moussard C. 2007)

If a high quantity of ethanol consumed is transformed, this will result in the increase in concentrations of produced acids. Therefore, uric acid becomes more insoluble in the organism and difficult to eliminate in the urine (Di Castelnuovo et al. 2002).

The same behavior is observed in Figure 2 with the students H, I, J, K.

One can note that the uric acid concentrations are different. However, the relation between volumes of consumed banana wine and concentrations of eliminated uric acid is similar to that of Figure 1.

**b. Case 2. B, E and F**

Figure 3 shows the variation of uric acid concentrations in eliminated urine after consumption of different quantities of banana wine.
In this figure one can figure out that after consumption of 135 cl, uric acid concentrations decrease as in the previous case. However, after 202.5 cl, the uric acid concentrations increase again. After contacting them, the students said that the discipline was not strictly observed. 67.5 cl of the wine have been taken before supper and the remaining wine has been drunk after.

One can note that the increase in concentrations after consumption of 202.5 cl is not very big. Therefore, the results can be considered as similar to others except the student L. If this subject is rejected (because it is considered as aberrant), we can consider the behavior of the mean. Table 2 shows the variation of uric acid concentrations in eliminated urines after consumption of different quantities of banana wine after rejecting L.

Table 2 Variation of uric acid concentrations in eliminated urine after consumption of different quantities of banana wine after rejecting L.

<table>
<thead>
<tr>
<th>Student label</th>
<th>Day 1 (after consumption of wine)</th>
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<tr>
<td>G</td>
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<td>64.38</td>
<td>20.0</td>
<td>16.30</td>
</tr>
<tr>
<td>H</td>
<td>41.68</td>
<td>63.24</td>
<td>40.2</td>
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</tr>
<tr>
<td>J</td>
<td>46.15</td>
<td>57.46</td>
<td>33.6</td>
<td>31.38</td>
</tr>
<tr>
<td>K</td>
<td>32.19</td>
<td>54.46</td>
<td>13.2</td>
<td>8.61</td>
</tr>
<tr>
<td>Mean</td>
<td>48.43</td>
<td>67.07</td>
<td>27.2</td>
<td>18.9</td>
</tr>
</tbody>
</table>

Even if uric acid concentrations are different (because metabolism is individual (Neuman et al. 2002; Marshall and Bangert, 2005)), the behavior of the 9 students is similar. For the whole sample, uric acid concentrations increase after consumption of 67.5 cl of the studied wine and decrease when increasing the volume of consumed wine. This phenomenon is clear in Figure 4 where the mean of uric acid concentrations is calculated.

Figure 4 can be considered as a general behavior. After drinking 67.5 cl of banana wine, one can note that uric acid becomes easy to eliminate in urine. The effect of 67.5 cl of banana wine is then the elimination of uric acid in urine. About 18.64 mg/dl of uric acid are eliminated after consumption of 67.5 cl of the studied wine. However, 135 cl of the same wine has the opposite effect. If one takes this volume of wine, about 21.43 mg/dl of uric acid are stocked in his organism. Increasing the volume to 202.5 cl will inhibit elimination of 29.53 mg/dl of uric acid.

CONCLUSION

In order to study the effects of consumption of local alcoholic drinks on people’s health, we investigated the local banana wine prepared with traditional procedure in Burundi. Using the same procedure, we have prepared and analyzed the local banana wine. Its alcohol content was 5.82 % and its pH was 3.88.

The obtained wine has been given to a sample of 10 students. They lived in the same conditions at the University of Burundi at the time of the study. After drinking different volumes of wine, their eliminated urine was analyzed to determine uric acid content.

The results show that consumption of the studied wine has important effects on health. In fact, elimination of uric acid plays an important role in many diseases as gout. It has been found that consumption of 67.5 cl of wine enhances uric acid elimination in urine. It is then possible to conclude that 67.5 cl of such local drink have a positive effect.

However, if the volume of consumed banana wine is increased uric acid is stocked in organism. As it is known hyperuricemia indicates many disorders. Therefore, if uric acid is not eliminated it will be deposited and will cause the phenomenon of hyperuricemia.

Our findings are analogous with other demonstrated relationship with other diseases (Di Castelnuovo et al. 2002; Maclure 1993; Rimm et al. 1999). Nevertheless, our analysis is more quantitative for a local drink. From those results, it is possible to determine a quantity of the studied wine which can be drunk without hyperuricemia. In that case, we think we will avoid many medical conditions.

Acknowledgement

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References