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Abuse of codeine separated from over-the-counter drugs containing acetylsalicylic acid and codeine

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Summary. In Denmark a new trend concerning the abuse of codeine has been observed. Danish drug abusers have discovered that codeine is easily separated from certain drugs containing acetylsalicylic acid and codeine. When separated the codeine can be used either orally or intravenously. Three different drugs combining acetylsalicylic acid and codeine are available in Denmark, but codeine is only easily separable from one of these. Applying the same procedure to the two other drugs produces unpredictable or unfavourable ratios of codeine to acetylsalicylic acid. In several countries, however, similar drugs combining acetylsalicylic acid and codeine are available. It is not possible from a list of constituents to predict how easily codeine can be separated from a particular drug. Therefore it is strongly recommended that relevant drugs are tested at local forensic laboratories. In case codeine is found to be very easily separated from a product appropriate action should be taken.

Key words: Acetylsalicylic acid – Codeine – Drug abuse – Narcotics

Zusammenfassung. Dänische Drogenabhängige haben vor kurzem herausgefunden, daß es möglich ist, Codein aus einigen der weitverbreiteten Acetylsalicylsäure/Codein-haltigen Kombinationspräparaten abzutrennen. Das Codein wird dann als billiges und „legales" Rauschmittel benutzt. Es wird entweder oral aufgenommen oder in die Venen gespritzt. In Dänemark gibt es drei entsprechende Kombinationspräparate, nur eines ist zur Codeinabtrennung geeignet. Die zwei anderen sind dafür nicht verwendbar, weil entweder zu geringe oder unvorhersehbare Codeinmengen sich abtrennen lassen. Es ist nicht möglich, aus der Wirkstoffzusammensetzung des Kombinationspräparates allein zu beurteilen, ob sich das Codein leicht abtrennen läßt. Kombinationspräparate, die Acetylsalicylsäure und Codein enthalten, werden in vielen Ländern frei verkauft. Es ist empfehlenswert, daß sie in unabhängigen Instituten überprüft werden, ob sich das Codein leicht abtrennen läßt. In entsprechenden Fällen sollte das Präparat galenisch verändert werden.

Schlüsselwörter: Acetylsalicylsäure – Codein – Drogenabhängige – Rauschmittel

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Introduction

In Denmark 3 different drugs combining acetylsalicylic acid (ASA) and codeine (C) (ASA-C) can be bought without a prescription [1]. Similar drugs are available in other countries, e.g. Germany, USA and the UK [2, 3]. A Danish product sold under the tradename Gelonida® allows an easy separation of codeine from the salicylic acid. Drug abusers perform the separation by placing 20, 40 or even 50 tablets in a coffee filter and dissolving the tablets in water. The coffee filter is then squeezed between the hands and the water soluble extract from the tablets is collected. The filter containing the remains of the tablets is discarded while the liquid is either taken orally or injected.

The aim of this study has been to investigate whether a separation of codeine from ASA-C combination drugs is actually possible by the method described. In case this was possible it would be interesting to see which concentration of codeine could be obtained through the use of ordinary household appliances. Finally, it was our intention to determine whether the procedure of separating codeine – if effective – applied only to Gelonida® or to other, similar drugs as well.

Materials and methods

The drugs examined contained acetylsalicylic acid in combination with codeine and can be bought without a prescription in Denmark. These included Gelonida® (containing 10 mg codeini phosphas hemihydricus and 500 mg acidum acetylsalicylicum), Kodi-

Table 1. Concentrations of acetylsalicylic acid and codeine after dissolving one tablet of Gelonida® in varying amounts of water followed by filtration or centrifugation. Theoretical values based on the solubility coefficient are shown for comparison

ml	Acetylsalicylic acid (mg/ml)			Codeine (mg/ml)		
	Calc. value	Filtrated	Centrifuged	Calc. value	Filtrated	Centrifuged
1.0	3.3	5.75	5.15	8.30	9.41	8.92
1.5	3.3	4.73	4.46	6.67	4.83	5.83
2.5	3.3	4.46	4.20	4.00	3.45	3.46
5	3.3	3.48	3.64	2.00	1.90	2.09
10	3.3	2.83	2.57	1.00	0.44	0.78
15	3.3	3.26	2.99	0.67	0.84	0.84
20	3.3	2.22	2.42	0.50	0.60	0.60
40	3.3	1.58	1.50	0.25	0.26	0.27
80	3.3	1.07	1.04	0.13	0.14	0.14
120	3.3	0.68	0.67	0.08	0.09	0.09
160	3.1	0.72	0.72	0.06	0.08	0.08
200	2.5	0.44	0.51	0.05	0.06	0.06

Table 2. Concentrations of acetylsalicylic acid and codeine after dissolving one tablet of Kodimagnyl® in varying amounts of water followed by filtration or centrifugation. Theoretical values based on the solubility coefficient are shown for comparison

ml	Acetylsalicylic acid (mg/ml)			Codeine (mg/ml)		
	Calc. value	Filtrated	Centrifuged	Calc. value	Filtrated	Centrifuged
1.0	3.3	118.49	104.78	8.30	3.82	4.25
1.5	3.3	88.23	74.60	6.67	1.24	2.64
2.5	3.3	77.02	41.38	4.00	0.54	1.04
5	3.3	50.41	17.26	2.00	0.09	0.22
10	3.3	24.47	13.83	1.00	0.11	0.02
15	3.3	17.84	13.34	0.67	0.55	0.63
20	3.3	14.19	10.00	0.50	0.46	0.50
40	3.3	4.54	4.09	0.25	0.24	0.24
80	3.3	2.74	2.35	0.13	0.13	0.31
120	3.3	1.40	1.31	0.08	0.09	0.25
160	3.1	1.46	1.11	0.06	0.06	0.14
200	2.5	1.20	1.05	0.05	0.06	0.13

magnyl® (containing 9.6 mg codeini phosphas hemihydricus, 500 mg acidum acetylsalicylicum and 70 mg magnesii oxidum) and Codyl® (containing 10 mg codeini phosphas hemihydricus, 500 mg acidum acetylsalicylicum and 70 mg magnesii oxidum) [1].

One tablet of each of the above menitoned drugs was dissolved in varying amounts of water and the liquid was either filtered or centrifuged prior to a quantitative analysis of codeine and acetylsalicylic acid.

Twelve different solutions were made for each drug. One tablet of each drug was dissolved in 1.0, 1.5, 2.5, 5.0, 10.0, 15.0, 20.0, 40.0, 80.0, 120.0, 160.0 and 200.0 ml of water respectively. It was not possible to dissolve a tablet in less than 1 ml of water and this was therefore the most concentrated solution obtained. The concentrations of acetylsalicylic acid (ASA) and codeine were measured by using HPLC (high pressure liquid chromatography) with 100% ASA and codeine as reference substances. We were unable to obtain reproducible results concerning the concentration of codeine in solutions of Codyl®, probably due to the coating of the tablets.

Results

The concentrations of ASA and codeine in the different solutions following filtration or centrifugation are shown in Tables 1–2. Theoretical values based on the solubility coefficient are shown for comparison.

Comparison of the results for the filtered and centrifuged solutions showed no difference between the 2 methods for the concentrations of ASA and codeine.

The concentration of ASA was found to increase gradually with decreasing amounts of water. For Gelonida® the concentration of ASA increased from 0.44 mg/ml in the 200 ml solution to 6.0 mg/ml in the 1 ml solution. For Kodimagnyl® the corresponding figures were 1.2 mg/ml and 118 mg/ml respectively. The use of Kodimagnyl thus resulted in higher ASA concentrations disregarding the amount of water in the solutions.

A gradual moderate increase in the concentration of codeine was observed with decreasing volume. A reduction of the amount of water from 200 ml to 5 ml produced an increase in the codeine concentration from 0.06 to 0.09 mg/ml for Kodimagnyl® and from 0.06 to 1.9 mg/ml for Gelonida®. A further reduction of the amount of water produced a sharp increase in the concentration of codeine up to a maximum of 3.8 mg/ml for Kodimagnyl® and 9.4 mg/ml for Gelonida®.

A detailed examination of the concentration curves showed that a decrease in solubility is observed at approximately 10 ml of water. We have no explanation for this

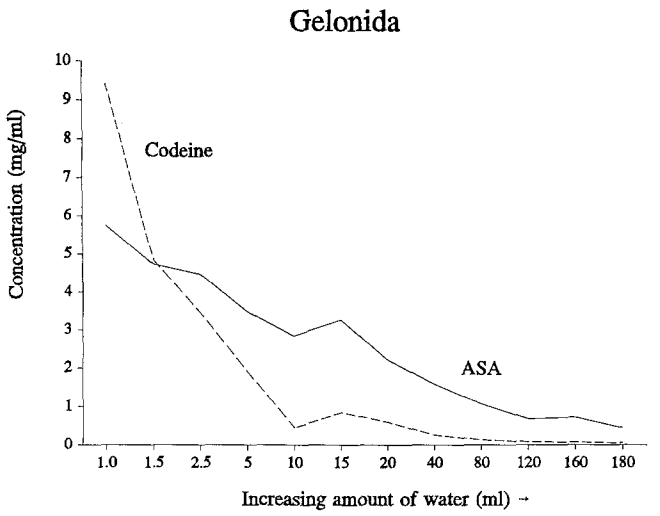

Fig. 1. Concentrations of acetylsalicylic acid and codeine after dissolving one tablet of Gelonida® in varying amounts of water

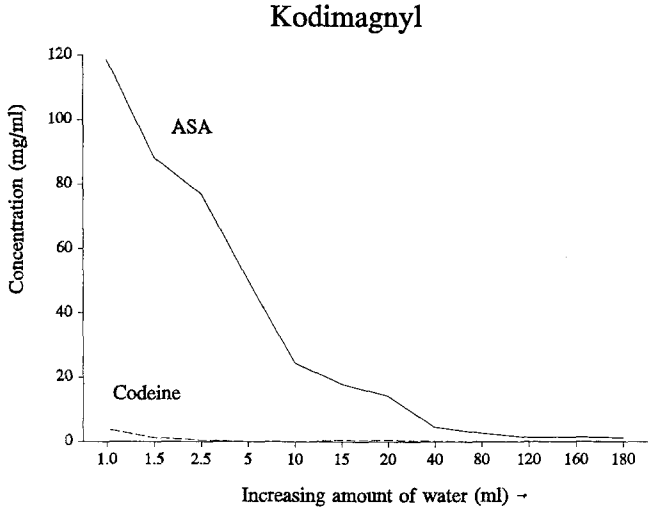

Fig. 2. Concentrations of acetylsalicylic acid and codeine after dissolving one tablet of Kodimagnyl® in varying amounts of water

phenomenon which applies to both Gelonida® and Kodimagnyl®.

Discussion

The solubility of ASA and codeine in water is 1:300 and 1:120 respectively [4]. Therefore the highest obtainable concentrations are 3.3 and 8.3 mg/l respectively. Solubility is, however, influenced by the pH value of the solution. The acidic constituent ASA is more easily soluble in alkaline solutions while the alkaline constituent codeine is more easily soluble in acidic solutions. This explains the different results obtained for Gelonida® and Kodimagnyl®. Moreover, it explains the differences between the values measured in this study and the theoretical calculations. Kodimagnyl®, but not Gelonida®, contains magnesium oxide added with the purpose of counteracting constipation caused by codeine. In this context however, the magnesium oxide is important in making the solution alkaline and thereby increasing the solubility of ASA and decreasing the solubility of codeine.

In all ASA-C combination drugs commonly used in Denmark the ratio of codeine to ASA is 10:500. The strongest possible solutions of ASA-C combination drugs have a codeine/ASA ratio of approximately 1.6 for Gelonida® and less than 0.05 for Kodimagnyl®. By applying the described method to Gelonida® it was possible to obtain a codeine/ASA ratio about 80 times higher than in the original product. This would provide a favourable solution for a "fix". Assuming that a "fix" requires 100 mg of codeine, 11 ml of Gelonida® solution or 25 ml of Kodimagnyl® would suffice. Such a "fix" would involve the intake of 60 mg of ASA with Gelonida® and 2600–3000 mg of ASA with Kodimagnyl®.

The unpredictability of the result for Codyl® in this study could probably be attributed to the coating of the tablets which may affect the solubility or rather the release of the ingredients when dissolving the tablets in water.

Conclusion

This study showed that it is possible to achieve fairly high concentrations of codeine in water by the dissolution of Gelonida® tablets. In fact, it was possible to obtain concentrations sufficiently high for abuse purposes without reaching a toxic level of ASA. Applying the procedure to other similar products made up of the same constituents produced unfavourable or unpredictable results. These findings indicated that tests should be carried out in other countries as well, in order to determine which locally available combination drugs are suitable for the separation of codeine. Drugs from which codeine is easily separated should be subject to existing regulations concerning pure codeine tablets.

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