Journal of Pharmaceutical and Medicinal Chemistry
Volume 2 Number 1, January - June 2016
DOI: http://dx.doi.org/10.21088/jpmc.2395.6615.2116.12

Review Article

Chac*toxi* Calc: A Computer Program for the Calculation of Chocolate Toxicity in Dogs

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Abstract

Assessment of chocolate toxicity is often carried out by veterinarians in pet clinics. The more reliable method used for this assessment is described here. The calculations involved in the assessment are complex, confusing, time consuming and not easily reproducible. Spreadsheet is a computer application in which data are arranged in rows and columns of a grid and can be manipulated and used in calculations. In today's era of smart phones, tablet PCs and netbooks, where a spreadsheet program in the form of Microsoft Excel [1] is readily accessible by most veterinarians, it should be possible to adapt the various laborious steps involved in the said method to a spreadsheet program by writing simple logical codes in the spreadsheets to do the calculations in a simple, clear, faster, reproducible, accurate and user friendly manner. This article describes a spreadsheet program (CHAC*Toxi* Calc) to calculate the chocolate toxicity

Keywords: Chocolate Toxicity Calculator; Chocolate Toxicity in Dogs; Toxicity Meter; Caffeine Poison in Dogs.

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Introduction

Assessment of chocolate toxicity is often carried out by veterinarians in pet clinics. The more reliable method used for this assessment is described here. The calculations involved in the assessment are complex, confusing, time consuming and not easily reproducible. Spreadsheet is a computer application in which data are arranged in rows and columns of a grid and can be manipulated and used in calculations. In today's era of smart phones, tablet PCs and netbooks, where a spreadsheet program in the form of Microsoft Excel [1] is readily accessible by most veterinarians, it should be possible to adapt the various laborious steps involved in the said method to a spreadsheet program by writing simple logical codes in the spreadsheets to do the calculations in a simple, clear, faster, reproducible, accurate and user friendly manner. This article describes a spreadsheet program (CHAC*Toxi* Calc) to calculate the chocolate toxicity [Figure 1].

Clinical signs usually occur within 6 to 12 hours of ingestion. Initial signs include polydipsia, vomiting, diarrhoea, bloating, and restlessness. Signs progress to hyperactivity, polyuria, ataxia, tremors, and seizures. Other effects include tachycardia, premature ventricular contractions, tachypnea, cyanosis, hypertension, hyperthermia, and coma. Less commonly, bradycardia and hypotension may occur. Hypokalaemia is possible late in the course of the toxicosis. Because of the high fat content of many chocolate products, pancreatitis is a potential sequel 24 to 72 hours after ingestion. Death is generally due to cardiac arrhythmias or respiratory failure.

Coding and Logical Data Used in this Program are as Follows;

Amount methyl xanthine in various chocolate types (mg/kg) is incorporated inC31 to C41 and D31 to D41

Compound	The obromine (mg/g)	Caffeine (mg/g)
White chocolate	0.00875	0.02975
Milk chocolate	2.03	0.21
Dark, sweet chocolate	4.55	0.7
Semi-sweet chocolate chips	4.83	0.77
Baker's (unsweetened) chocolate	13.755	1.645
Dry cocoa powder	25.795	2.45
Instant cocoa powder	4.76	0.525
Cocoa beans	21	NA
Coffee beans	0	21
Cocoa bean hulls	8.925	NA

Amount of Theobromine Can Be Calculated By Using the Logics As Shown Below

K18 = =D17*C32 (theobromineinWhite chocolate)

K19 = =D18*C33 (theobromineinMilk chocolate)

K20 = =D19*C34 (theobromineinDark, sweet chocolate)

K21 = =D20*C35 (theobromineinSemi-sweet chocolate chips)

K22 = =D21*C36 (theobromineinBaker's (unsweetened) chocolate)

K23 = =D22*C37 (theobromineinDry cocoa powder)

K24 = =D23*C38 (theobromineinInstant cocoa powder)

K25 = =D24*C39 (theobromineinCocoa beans)

K26 = =D25*C40 (theobromineinCoffee beans)

K27 = =D26*C41 (theobromineinCocoa bean hulls)

Amount of Caffeine Can Be Calculated By Using the Logics As Shown Below

L18 = =D17*D32 (caffeine inWhite chocolate)

L19 = =D18*D33 (caffeine inMilk chocolate)

L20 = =D19*D34 (caffeine inDark, sweet chocolate)

L21 = =D20*D35 (caffeine inSemi-sweet chocolate chips)

L22 = =D21*D36 (caffeine inBaker's (unsweetened) chocolate)

L23 = =D22*D37 (caffeine inDry cocoa powder)

L24 = =D23*D38 (caffeine inInstant cocoa powder)

L25 = =D24*D39 (caffeine inCocoa beans)

L26 = =D25*D40 (caffeine inCoffee beans)

L27 = =D26*D41 (caffeine inCocoa bean hulls)

Dose Theobromine received (mg/kg) can be calculated by the logics as shown below

F16 =SUM (K18:K27)/ (C14)

F17 (Dose Caffeine received (mg/kg)) =SUM (L18:L27)/ (C14)

F18 (Total Dose Methyl xanthine (mg/kg)) = F16+F17

Emergency Treatment Needed? Or not? Can be calculated by using the logic as shown below

=IF (OR (OR(F16>40, F17>40), (F16+F17)>40), "YES!!", "No")

Based on ASPCA Animal Poison Control Centre (APCC) experience, mild signs occur in animals ingesting 20 mg/kg of theobromine and caffeine, severe signs are seen at 40-50 mg/kg, and seizures occur at 60 mg/kg based on ASPCA/APCC Database: data (2).Doses from 20-40mg/kg may causing vomiting, diarrhoea. Doses > 40mg/kg should be decontaminated and then treated based on amount ingested and clinical signs.

One representative study is presented to help and understand the usefulness of the program. The findings of the experiment along with the calculation are presented as a screenshot of the program [Figure 1].

The difficulty which usually concerns veterinarians in clinic the toxicity assessment. They often encounter the following problems:

- The calculations involved in the assessment are time consuming
- The calculations appear confusing when reviewed at a later date

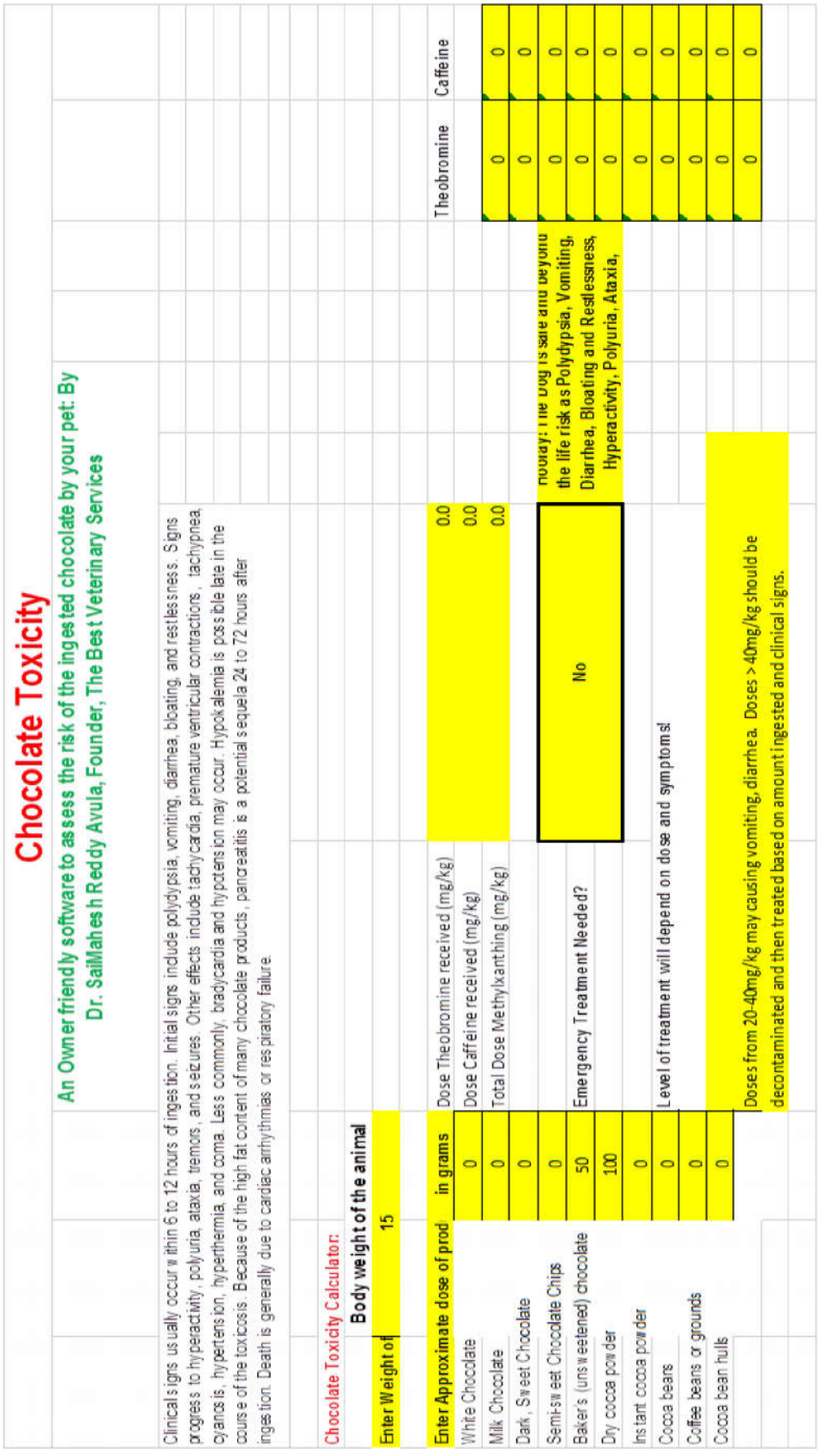

Fig. 1: Chocolate toxicity meter by using the developed spread sheet

- It is often difficult to explain in a report or communication how the final figure was arrived at.

The program described here can easily solve the above problems. It can be used to store, process, analyse and graphically represent data. A formula entered in a cell in the spreadsheet defines how the content of that cell is to be calculated from the contents of any other cell(s) each time the content of the other cell(s) is updated.

The program was thoroughly tested for the entire range of possible values. As the spreadsheet makes the whole process of assessment faster and user friendly, the program will be useful to veterinary professionals who are working in veterinary hospitals.

References

1. Available from: http://www.office.microsoft.com/en.us/excel. [Last accessed on 2016 Mar 23].
2. ASPCA/APCC Database: published data on 18 April 2015.