Inhibitory Effects of Some Philippine Medicinal Plants on Germ Cell Genotoxicity of Methylmethansulfonate, Tetracycline, and Chloromycetin

Clara Y. Lim-Sylianco, R. Abian, and F.R. Blanco
Institute of Chemistry
College of Science

Abstract

Methylmethansulfonate, tetracyline, and chloromycetin were shown to be genetoxic to germ cell. These genotoxins induced reduction in fertility index, gestation index, and implantation index. The percentage dead implants and percentage of females with resorptions were increased.

Decoctions from bayabas, kalatsutsi, kamias, kogon, makabuhay, malunggay, mayana, sambong, tanglad, and ulasimang bato increased fertility index, gestation index, implantation index, and reduced percentage dead implants and percentage of female with resorption.

Introduction

Somatic cell genotoxins can induce cancer while germ cell genotoxins can cause sterility and genetic disorders that can be transmitted from one generation to the next.

We have previously identified about fifty Philippine medicinal and food plants that exhibited inhibitory effects to somatic cell genotoxins (1) (2) (3).

It would be of interest to know if inhibitory effects will also be shown by medicinal and food plants against germ cell genotoxins. This report deals with this aspect.

Experimental Methods

The dominant lethal test by Generoso (4) was used in this study. The genotoxins were administered intraperitoneally. Simultaneously, the plant decoctions were administered by oral gavage to male Swiss Webster mice. After six days the treated male mouse was mated with 2

females. The first day of pregnancy was marked for each female after examination of vaginal plugs. On the 18th day of pregnancy, the female mouse was killed and the uterus removed carefully. The live and dead fetuses were recorded as well as resorption and implantation sites. Fertility index, gestation index, implantation index, percentage dead implants and percentage of females with resorptions were calculated.

Results and Discussion

Methylmethansulfonate, tetracycline, and chloromycetin exhibited genotoxicity to germ cells (Table 2). These induced reduction of fertility index, gestation index, and implantation index. An increase in percentage dead implants and percentage of females with resorptions were induced by these genotoxins. It is possible that these genotoxins altered the structure of DNA of the sperm cells of the male mouse, inducing the effects observed in the female mouse.

When decoctions were administered simultaneously with the genotoxins, there was an increase in fertility index, gestation index, implantation index, and a reduction in percentage dead implants and percentage of females with resorptions.

With methylmethansulfonate, increase in the concentration of decoctions of kalatsutsi, kamias, malunggay, and ulasimang bato increased the fertility index and gestation index. Increasing the concentration of the decoctions of kogon, mayana, and ulasimang bato reduced the percentage of females with resorptions (Table 3).

With tetracycline, increasing the concentration of decoctions from kalatsutsi, kogon, mabuhay, mayana, and tanglad increased the fertility index. Increasing the concentration of the decoctions from bayabas, kalatsutsi, kamias, mabuhay, sambong, and ulasimang bato increased the gestation index. The percentage dead implants were reduced by increasing the concentration of decoctions from bayabas, kamias, makabuhay, mayana, sambong, tanglad, and ulasimang bato. In all cases the percentage of females with resorptions was reduced with increasing concentration of the decoctions from the plants used (Table 4).

With chloromycetin, increase in the concentration of decoctions from kogon, makabuhay, and ulasimang bato increased the fertility index. Increasing the concentration of the decoction from tanglad increased the

gestation index. Increase in the concentration of decoctions from kalatsutsi, kamias, kogon, malunggay, mayana, sambong, tanglad, and ulasimang bato reduced the percentage dead implants. Increasing the concentration of decoctions from all the plants used reduced the percentage of females with resorptions (Table 5).

These results show that the decoctions from the Philippine medicinal and food plants showed inhibitory effects on germ cell genotoxicity of methylmethansulfonate, tetracycline, and chloromycetin. Further studies are needed to identify the component that is responsible for the inhibitory effects from each plant tested.

Conclusion

Methylmethansulfonate, chloromycetin, and tetracycline are genotoxic to germ cell of the experimental mice. These reduced the fertility index, gestation index, and implantation index while percentage dead implants and females with resorptions were increased.

Decoctions from bayabas, kalatsutsi, kamias, kogon, makabuhay, malunggay, mayana, sambong, tanglad, and ulasimang bato increased the fertility index, gestation index, and implantation index. The percentage dead implants and females with resorptions were decreased.

Studies are being undertaken to determine the chemical nature of the inhibitors from these plants.

Acknowledgment

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References

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Table 1. Philippine Medicinal Plants Used in this Study

Local Name	Scientific Name	Parts Used
Bayabas	*Psidium guajava* Linn.	Leaves
Kalatsutsi	*Plumeria acutifolia* Poir.	Leaves
Kamias	*Averrhoa bilimbi* Benth.	Bark and stem
Kogon	*Imperata cylindrica* Linn.	Roots
Makabuhay	*Tinospora rumphii* Boerl.	Stem
Malunggay	*Moringa oleifera* Lam.	Leaves
Mayana	*Coleus blancoi* Benth.	Leaves
Sambong	*Blumea balsamifera* Linn.	Leaves
Tanglad	*Cymbopogon citratus* Stapf.	Stem
Ulasimang bato	*Piperonia pellucida* Linn.	Leaves

Table 2. Germ Cell Genotoxicity of Methylmethansulfonate, Chloromycetin, and Tetracycline

	FI	GI	II	DI	FR
Methylmethansulfonate (10 mg/kg)	75.8	61.5	7.2	38.5	85.7
Chloromycetin (100 mg/kg)	75.0	70.1	7.7	34.3	88.9
Tetracycline (55 mg/kg)	60.7	73.4	7.3	29.8	100.0
CONTROL	97.6	97.8	10.2	4.3	45.0

FI Fertility index = $\frac{\text{No. of females pregnant}}{\text{No. of females mated}} \times 100$

GI Gestation index = $\frac{\text{No. of live implants}}{\text{Total No. of implantations}} \times 100$

II Implantation index = $\frac{\text{Total implantations}}{\text{No. of females pregnant}} \times 100$

DI % Dead Implants

FR % Females with Resorption

Table 3. Inhibitory Effetcs of Philippine Medicinal Plants on Germ Cell Genotoxicity of Methylmethansulfonate

	FI	GI	II	DI	FR
Methylmelthansulfonate alone	75.8	61.5	7.2	38.5	85.7
plus Bayabas					
40% decoction	100.0	88.9	8.0	11.1	55.6
80% decoction	98.7	87.9	7.9	13.4	57.6
plus Kalatsutsi					
40% decoction	80.9	96.7	7.9	3.3	32.6
80% decoction	97.5	98.6	8.1	3.5	37.8
plus Kamias					
40% decoction	86.5	87.6	8.2	13.0	50.0
80% decoction	91.2	92.3	8.8	12.0	49.2
plus Kogon					
40% decoction	80.9	76.5	10.7	10.9	60.1
80% decoction	83.2	77.8	10.2	9.2	56.8
plus Makabuhay					
40% decoction	90.9	87.6	8.8	11.5	64.3
80% decoction	90.8	88.7	8.5	11.8	65.8
plus Malunggay					
40% decoction	90.8	87.5	9.0	12.8	27.8
80% decoction	95.6	96.5	8.9	3.5	30.0
plus Mayana					
40% decoction	82.6	84.7	9.2	15.2	43.2
80% decoction	86.7	88.5	9.2	13.2	38.2
plus Sambong					
40% decoction	80.4	89.7	8.8	10.2	70.2
80% decoction	83.4	88.7	8.8	9.0	69.9
plus Tanglad					
40% decoction	90.7	90.6	9.4	9.4	60.0
80% decoction	91.4	90.9	9.2	9.6	66.7
plus Ulasimang Bato					
40% decoction	80.6	85.2	8.7	14.8	42.9
80% decoction	84.5	86.7	9.0	15.2	39.8

Table 4. Inhibitory Effects of Philippine Medicinal Plants on Germ Cell Genotoxicity of Tetracycline

	FI	GI	II	DI	FR
Tetracycline alone	60.7	73.4	7.3	29.8	100.00
plus Bayabas					
40% decoction	100.0	85.7	9.8	14.4	75.0
80% decoction	100.0	89.4	9.8	10.6	50.0
plus Kalatsutsi					
40% decoction	75.0	96.5	8.7	3.8	34.2
80% decoction	83.2	97.9	9.1	3.2	29.8
plus Kamias					
40% decoction	100.0	92.8	8.7	7.2	45.0
80% decoction	100.0	94.3	9.1	5.9	34.8
plus Kogon					
40% decoction	90.8	88.9	9.1	11.1	10.9
80% decoction	98.7	88.9	9.0	11.0	10.1
plus Makabuhay					
40% decoction	87.6	90.2	10.2	9.8	62.2
80% decoction	92.9	96.3	9.8	3.7	33.3
plus Malunggay					
40% decoction	100.0	90.8	8.4	9.2	44.4
80% decoction	100.0	89.9	10.3	9.8	40.6
plus Mayana					
40% decoction	90.8	89.9	10.0	20.0	67.8
80% decoction	98.8	89.1	11.0	12.3	47.8
plus Sambong					
40% decoction	100.0	85.6	10.1	25.0	65.7
80% decoction	100.0	90.0	10.3	9.1	57.1
plus Tanglad					
40% decoction	94.5	90.2	10.2	9.8	62.7
80% decoction	98.7	91.8	9.7	8.2	60.0
plus Ulasimang Bato					
40% decoction	100.0	84.8	9.2	17.7	58.9
80% decoction	100.0	87.6	9.2	14.6	49.7

Table 5. Inhibitory Effects of Philippine Medicinal Plants on Germ Cell Genotoxicity of Chloromycetin

Chloromycetin alone	FI	GI	II	DI	FR
plus Bayabas					
40% decoction	100.0	88.8	8.0	11.2	50.0
80% decoction	100.0	90.1	10.9	11.2	45.9
plus Kalatsutsi					
40% decoction	98.2	92.3	9.3	13.9	34.4
80% decoction	98.6	90.3	9.1	10.9	32.7
plus Kamias					
40% decoction	89.4	82.3	8.1	14.4	50.0
80% decoction	85.3	90.2	8.3	11.3	43.3
plus Kogon					
40% decoction	96.6	90.2	7.9	10.0	25.4
80% decoction	98.2	89.7	8.1	8.8	18.0
plus Makabuhay					
40% decoction	92.3	93.8	9.2	6.2	20.0
80% decoction	94.3	90.3	9.6	6.0	19.9
plus Malunggay					
40% decoction	100.0	90.6	9.4	6.4	30.0
80% decoction	100.0	90.4	9.4	5.2	22.3
plus Mayana					
40% decoction	95.5	96.6	9.2	15.4	27.2
80% decoction	95.7	97.1	9.1	13.2	23.4
plus Sambong					
40% decoction	90.0	88.7	9.3	21.3	37.2
80% decoction	90.4	89.9	9.2	11.2	23.4
plus Tanglad					
40% decoction	89.9	86.2	8.1	21.6	56.7
80% decoction	87.6	89.1	8.6	19.8	45.6
plus Ulasimang bato					
40% decoction	90.1	94.3	8.1	15.5	58.7
80% decoction	93.2	94.2	8.6	13.2	47.6