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Effects of external qì on the growth and survival of *Orbicella faveolata* coral micro fragments grown in nurseries of the National Institute of Fisheries and Aquaculture, Puerto Morelos, Quintana Roo, Mexico.

Citlalli Álvarez[1], Sofía González Becerril[2], Benjamín Muñoz[3] and Andrea Dovarganes[4]

[1]The Best of Me - Zhìnéng Gìgōng Training and Scientific Research Institution. Mexico, City.
Email: yesca1967@yahoo.com
[2] Social Security Mexican Institute Psychology, Mexico City
[3]Crane flight, Mexico City.
[4] Health coach, Mexico, City.

Abstract - **The effects of the qì emission on the *Orbicella faveolata* coral micro fragments with 2 different genotypes in laboratory grown has been studied. A total of 64 micro fragments were randomly divided forming the control and experimental groups. The 32 micro fragments of the experimental group received a non-invasive qì treatment during10 minutes for 3 weeks. The survival and growth of both groups was recorded. The corals that received the external treatment survived to a greater extent than those which had not receive it. The corals that received qì grew more compared to the corals which did not receive qì. The micro fragments that received qì were more resistant to contamination by ciliates. It is suggested to perform more trials with a greater population number.**

Keywords - **coral micro fragments, external qì, laboratory culture, *Orbicella faveolata,* zhìnéng qìgōng.**

I. INTRODUCTION

Since ancient times the great Chinese masters have worked with the qì to cure diseases and to stay healthy [1], [2]. The qì is a Chinese term that refers to the force that makes up and binds together all things in the universe. In 1981, the master and doctor Páng Hè Míng made known to the public the Zhìnéng qìgōng, Chinese science that works with the qì to promote the physical, mental, and emotional health of the practitioner [1] - [3]

Zhìnéng qìgōng practitioners begin their preparation with internal practice, that means, they perform physical, and mental exercises in order to get greater quantities of qì in their body therefore balancing their functions. Over time, the practitioners are able to pass on qì to other people without touching them which will improve overall health. This practice has been scientifically researched on patients, animals, plants, cells, organisms in culture media, and even with inorganic materials [4] - [8]; although this type of research is becoming more common worldwide, we did not find previous studies with corals in English or Spanish.

The high degradation of coral reefs is unfortunate because, in addition of having great tourist value, they are ecosystems that harbor species of high commercial value generating economic, and social benefits to the community. It is for these reasons that, in 2017, the National Institute of Fisheries and Aquaculture of Puerto Morelos in Quintana Roo, Mexico, began to implement a coral culture program for reefs restoration [9].

II. METODOLOGY

With an initial population of 64 *Orbicella faveolata* coral micro fragments with 2 different genotypes, the corals were randomly divided into two groups with 32 micro fragments for the control group and 32 micro fragments for the experimental group. Initial photos of the micro fragments of both groups were taken (Figs. 1 and 2) and the initial area of each micro fragment was measured with the "Image J" program.

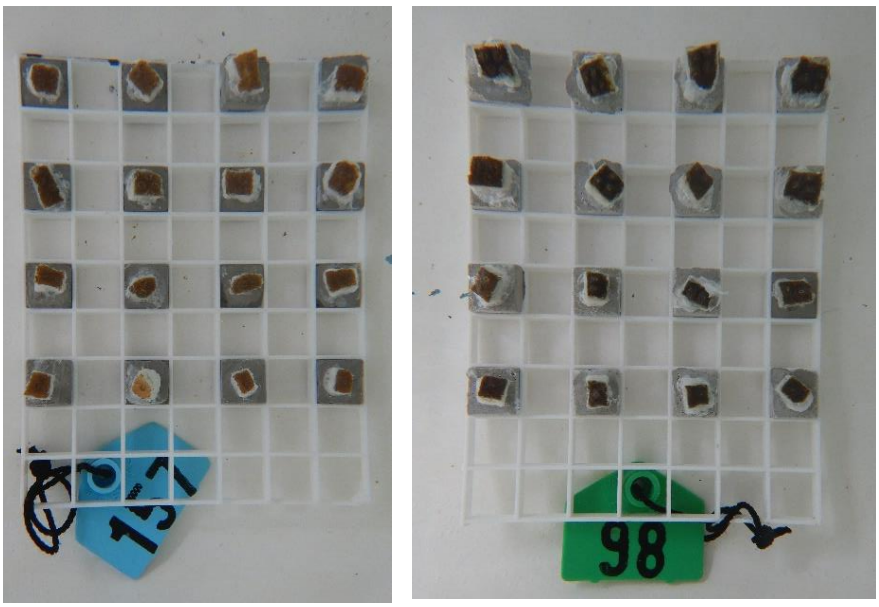

Fig. 1. Control group with 32 *Orbicella faveolata* micro fragments in 2 different genotypes.

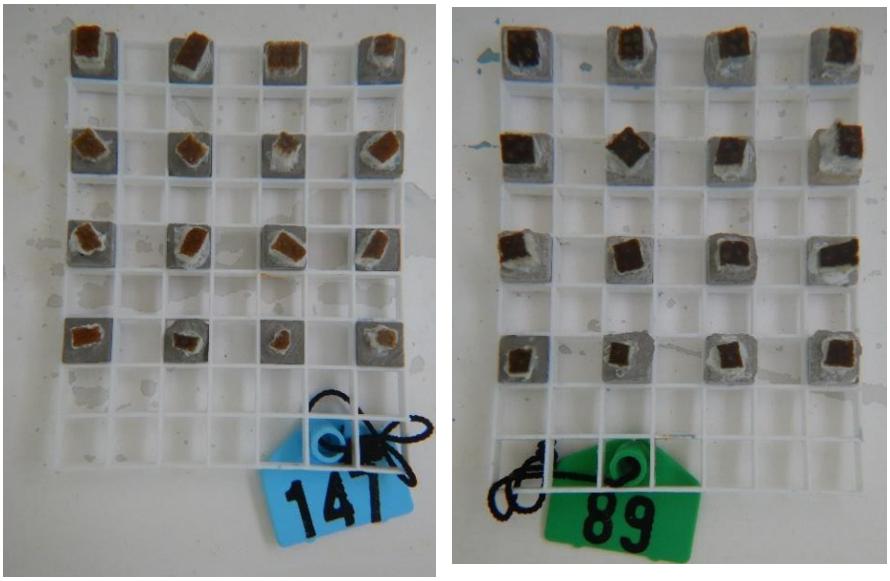

Fig. 2. Experimental group with 32 *Orbicella faveolata* micro fragments in 2 different genotypes.

Both groups were maintained under the same environmental conditions (Fig. 3) and the non-invasive external qì treatment was applied daily to the experimental group for 10 minutes for 3 weeks (Fig. 4).

Three days before concluding the project, a ciliated infection was detected in the micro fragments of both groups and a mechanical treatment was performed to eliminate them (Fig. 5). The sanitary measure also included the transfer of the micro fragments to smaller containers (Fig. 6).

Fig. 3. Experimental and control groups in the same environmental conditions.

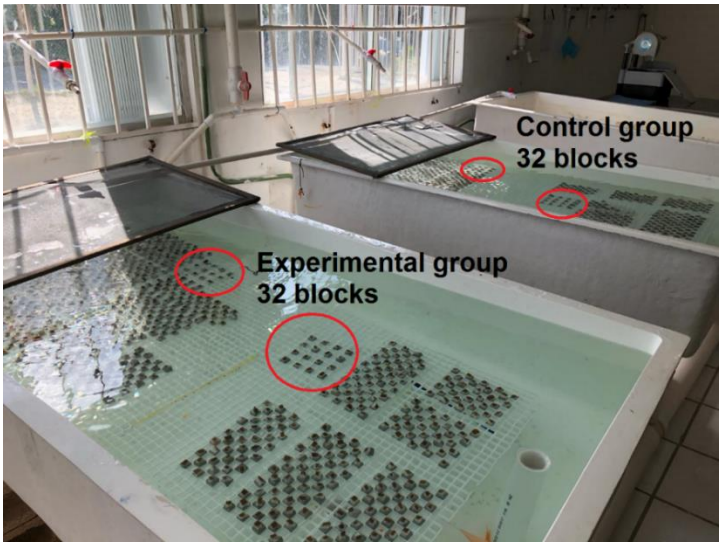

Fig. 4. Non-invasive external qì treatment to the experimental group.

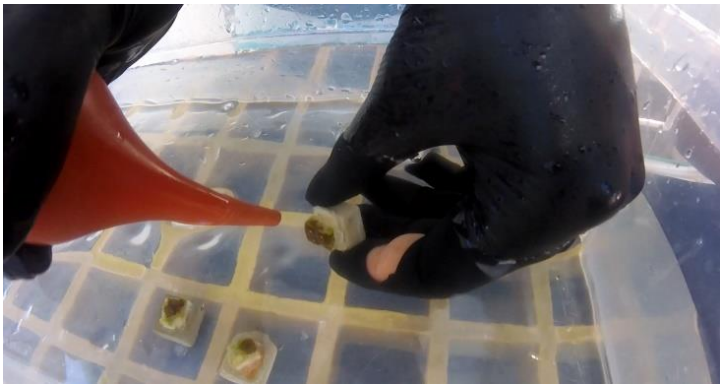

Fig. 5. Mechanical treatment to eliminate the ciliates of the micro fragments of both groups.

Fig. 6. Control and experimental groups in smaller containers.

At the end of the 3 weeks treatment, photos were taken again, the number of surviving micro fragments in both groups was counted (Figs. 7 and 8), and the final area of each fragment was measured with the "Image J" program. The data obtained were analyzed statistically.

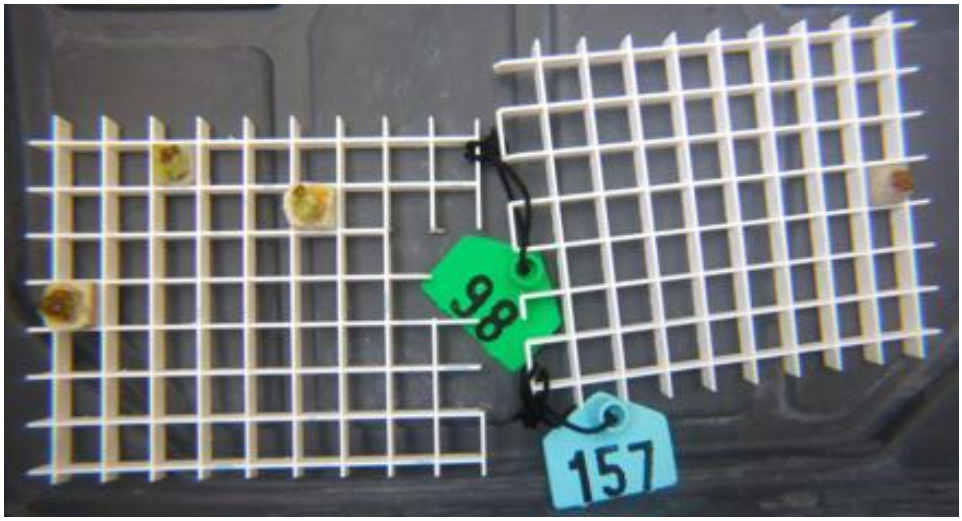

Fig. 6. Control group surviving micro fragments:
4 micro fragments = 12.5% survival.

Fig. 7. Experimental group surviving micro fragments:
25 micro fragments = 78% survival.

III. DATA ANALYSIS

Data were analyzed with the IBM SPSS 19 statistical package. Initial population of 64 coral micro fragments randomly divided into two groups, control and experimental, with 32 elements each (Table 1).

Table 1. Total sample of micro fragments of corals per group at the beginning of the experiment.

NUMBER OF CORALS AT THE START OF THE EXPERIMENT

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Control	32	100.0	100.0	100.0
	Experimental	32	100.0	100.0	100.0

At the end of the experiment, we found that in the control group the survival rate was 12.5% (4 corals) and the mortality rate was 87.5% (28 corals) (Table 2). While in the experimental group the survival rate was 78.1% (25 corals) and a mortality rate was 21.9% (7 corals) (Table 3) (Fig.8).

Table 2. Number of surviving and non-surviving micro fragments of the control group in the last week of the experiment.

LAST WEEK CONTROL GROUP

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Non-Survivors	28	87.5	87.5	87.5
	Survivors	4	12.5	12.5	100.0
	Total	32	100.0	100.0	

Table 3. Number of surviving and non-surviving micro fragments of the experimental group in the last week of the experiment.

LAST WEEK EXPERIMENTAL GROUP

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Non-Survivors	7	21.9	21.9	21.9
	Survivors	25	78.1	78.1	100.0
	Total	32	100.0	100.0	

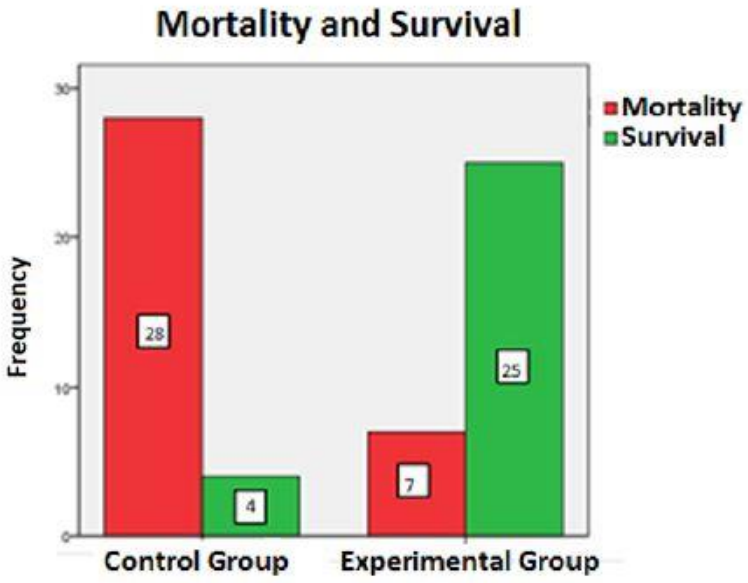

Fig. 8. The graph shows the number of micro fragments that did not survive (red) and the number of micro fragments that survived (green) at the end of the experiment. The first two columns belong to the control group and the next two to the experimental group.

Chi square analysis was run to know if there was statistically significant difference in survival between the group of corals that received qì (experimental) and those that did not receive it (control group).

Ho: There is no difference in coral survival between those which received the external qì treatment (experimental group) and those which did not receive it (control group).

Finding that: with $X^2 = 27.807$, gl = 1, p = 0.000, as the significance is less than 0.05, Ho is rejected, therefore, there is a difference with respect to survival between those corals that received qì and those that did not receive (Table 4).

Table 4. Chi Square Test Results Table

	Value	gl	Sig. asymptotic (bilateral)
Pearson's Chi-square	27,807[to]	1	.000
Reason for plausibility	30,426	1	.000
Linear association by linear	27,372	1	.000
N of valid cases	64		

a. 0 squares (.0%) have an expected frequency of less than 5. The minimum expected frequency is 14.50.

b. Calculated only for a 2x2 table.

Also, to analyze the area data (growth) of the micro fragments obtained with the "Image J" program, a "t student" analysis was carried out for related samples for each group, matching the samples with the surviving corals.

Ho: There are no differences in the size (growth) of the corals between the initial and final measurement.

IV. RESULTS

Control group: An initial mean of 3419.3320 and a final mean of 3198.3968 was found (Table 5). The correlation between the groups is .986 (Table 6).

Table 5. t student test results for related samples to the initial and final measurement of the control group.

Statistics of related samples

	Mean	N	Typical deviation	Mean typical error
INITIAL MEASURE	3419.3320	4	443,68182	221,84091
FINAL MEASURE	3198.3968	4	2788.15301	1394.07650

Table 6. Correlation results between the initial and final measurement of the control group.

Related sample correlations

	N	Correlation	Sig.
PAR 1. INITIAL AND FINAL MEASUREMENT	4	.986	.014

A t-value of .188, gl = 3 degrees of freedom and p = 0.863 greater than 0.05 is observed, so the size of the corals that did not receive qì is not different between the first and second measurements (Table 7).

Table 7. t student test results for related samples with the initial and final measurement of the control group.

Related samples test

	Related differences					t	gl	Sig (bilateral)
	Mean	Typical deviation	Mean typical error	95% Confidence interval for difference				
				Lower	superior			
PAR 1. INITIAL AND FINAL MEASURMENT	220.93525	2351.75579	1175.87790	-3521.23301	3963.10351	.188	3	.863

Experimental group: An initial mean of 5517.7621 and a final mean of 7495.7713 was found (Table 8). The correlation between the groups is .987 (Table 9).

Table 8. Student t test statistics for related samples with the initial and final measurement of the experimental group.

Statistics of related samples

	Mean	N	Typical deviation	Mean typical error
INITIAL MEASURE	5517.7621	25	1460.44448	292,08890
FINAL MEASURE	7495,7713	25	2643,67699	528,73540

Table 9. Results of the correlation between the initial and final measurement of the experimental group.

Related sample correlations

	N	Correlation	Sig
PAR 1. INITIAL AND FINAL MEASUREMENT	25	.987	.000

A t-value of -8.083, gl = 24 degrees of freedom and p = 0.000 less than 0.05 is observed, so the size of the corals that received qì is different between the first and second measurements (Table 10).

Table 10. t student test results for related samples with the initial and final measurement of the experimental group.

Testing related samples

	Related differences					t	gl	Sig. (bilateral)
	Mean	Typical deviation	Mean typical error	95% Confidence interval for difference				
				Lower	superior			
PAR 1. INITIAL AND FINAL MEASURMENT	-1978.00920	1223.54806	244,70961	-2483.06502	-1472.95338	-8.083	24	.000

V. CONCLUSIONS

1. The corals that received the external treatment survived to a greater extent than those which had not receive it.
2. The corals that received qì grew more in comparison with the corals which did not receive qì.
3. The micro fragments that received qì were more resistant to contamination by ciliates.

It is suggested to continue doing more trials with a larger population and with different species.

VI. ACKNOWLEDGMENTS

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