ORIGINAL ARTICLE

Effect of Monosodium Glutamate on Wall thickness of Fallopian tubes of Albino Rats

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ABSTRACT

Background: Monosodium Glutamate is a mono sodium salt of a naturally occurring amino acid i.e. glutamic acid. It gives meaty taste thus improves food palatability & appetite.
Aim: To evaluate the effects of MSG given to the albino rats on morphology & histology of fallopian tubes.
Methods: Sample size of 45 female adult albino rats was taken i.e. 15 animals in each of three groups; control group (A), low dose experimental group (B) and high dose experimental group (C). Animals of group B were given a dose of 0.04 mg/kg body weight of MSG after dissolving in 1 ml of distilled water for 14 days through orogastric tube and that of group C were given a dose of 0.08 mg/kg body weight after dissolving in 1 ml of distilled water for equal days. Group A animals received only equal amount of distilled water without any salt for same days. Dissection was made on the fifteenth day of the experiment of all animals. Abdomens were opened and fallopian tubes were identified. They were cleared from surrounding tissues and dissected out. Gross examination of each was done for any change in appearance. They were then weighed and their lengths were taken. Proper fixation of tissue was done and then 5µm serial sections of tissues were made. Hematoxylin/eosin staining was performed for detailed histological study of the tissue. Wall thickness of each tube was measured from three sites by ocular micrometery.
Results: Wall thickness of Group B (low dose experimental) was more than Group C (high dose experimental).
Conclusion: MSG when given orally for short period of time causes effects on fallopian tubes so its use for longer time can cause severe effects.
Key words: Monosodium Glutamate (MSG), fallopian tubes.

INTRODUCTION

Monosodium glutamate (MSG) is a mono sodium salt of glutamic acid[1]. It is most common trade name is Ajinomoto. It adds meaty taste to the food so is considered as one of the good flavor enhancer and additive[2]. However various vaccines also contain it as a preservative[3].

It's the L-glutamate component of MSG that causes enhancement of flavor of food and sodium component adds salty taste to it. It is nowadays being frequently used as food additive and also in processed food. Although its use has been increasing day by day throughout the world but is it safe or not for health is still questionable.[4] Various complaints like headache, nausea, vomiting, numbness, palpitations, sweating etc. have been reported since late 60's and later on its retinotoxic, neurotoxic, nephrotoxic effects were also observed in various animal studies with different doses. Adverse effects in humans have also been reported[5]. It has some role in the development of Alzheimer's disease.

MSG is also causing damage to male reproductive tract as different animal studies on testis and prostate resulted in testicular damage by causing hemorrhage and degeneration of the stroma. It has also resulted in causing alteration of sperms count and morphology[6] & is found to be a potentiating factor in prostatic pathologies[7]. In other words it is implicating in male infertility. Animal studies are also carried on female reproductive organs. It has been found to cause atrophic changes in oocytes, marked cystic degeneration and atretic follicles in ovaries[8]. Due to its extensive use and multiple effects recent research work was designed to observe the effects of MSG given to the albino rat on histology and morphology of fallopian tubes.

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MATERIALS AND METHODS

A sample size of 45 adult female albino rats was purchased. They were acclimatized for two weeks in animal house of Punjab Post Graduate Medical Institute, Lahore. Free access to food and water was made possible. Special feed[9] was provided to rats & were randomly[10] assigned into three groups a control group A & two experimental groups low dose B and high dose C respectively.

Group A- (Control): It was control group containing 15 albino rats - given equal amount of distilled water through orogastric tube without MSG for two weeks.

Group B- (Low Dose Experimental): It was low dose experimental group containing 15 albino rats – given MSG 0.04 mg/kg/day for two weeks dissolved in 1ml distilled water through orogastric tube.

Group C- (High Dose Experimental): It was high dose experimental group containing 15 albino rats - given 0.08 mg/kg/day of MSG for two weeks dissolved in 1ml distilled water through orogastric tube.

Dissection of all animals was made on the fifteenth day of the experiment. They were first given analgesia with morphine and then anesthetized with sodium pentabarbitone by giving an intraperitoneal injection.[11] Fixation was done in supine position on dissection board, abdominal cavity were opened by giving anterior midline incision in anterior abdominal wall. Gut loops were kept aside and bilateral uterine tubes were approached, cleared from both ends & were taken out. Gross inspection was done for any apparent change. Weights and lengths of

tubes were taken and were then fixed in formaldehyde for a day. Paraffin wax blocks of fixed tissues were made.[12] Microtome was used to take serial section of 3-5 microns thickness. Glass slides of these sections were prepared & stained with haematoxylin and eosin (H&E) method[13].

Thickness of wall of each fallopian tube was measured from outer wall to the base of mucosal fold with the help of occulometer[14] from ovarian end, uterine end and middle of tube.

Statistical analysis: SPSS version 17.0 was applied for data analysis. Qualitative & quantitative variables were observed. Comparison of these variables was performed using Chi-square test & ANOVA. Post-hoc analysis was applied using Tukey's test where required. Statistically significant is P-value ≤ 0.05.

RESULTS

Wall thickness at lateral (ovarian) end of the tube was recorded as 0.80±0.11 mm in control group A, in low dose experimental group B it was 0.85±0.21mm and in high dose experimental group C it was 0.68±0.14 mm as mentioned in Table 1. According to observations thickness of walls of fallopian tubes of these groups differ significantly from each other at this site (Table 2).

Individual group comparison resulted that control group animals had a statistically insignificant difference with experimental groups (low & high dose). However comparison of experimental groups reported that the difference in thickness of both low & high dose groups B and C was significant and even walls of fallopian tubes of low dose experimental group B were more thickened than those of high dose experimental group C (Table 3).

When thickness was taken at about half of the tube, it was 0.81±0.10 mm in control group A. However in low dose experimental group it was 0.89±0.25 mm and in high dose experimental group C it was 0.68±0.09 mm as mentioned in Table 4. Difference for wall thickness at this site i.e. at the mid or half of tube between these groups was significant (Table 5).

When thickness of walls at the middle of fallopian tubes was compared group wise it showed that the difference in thickness of tubes of animals of low & high dose experimental groups from control group was not significant. However the tubes of both experimental groups B and C differ significantly from each other & even group B having more thick walls as mentioned in Table 6.

Thickness of walls of tube at medial (uterine) end was also calculated. It was 0.79±0.11mm in control group A, 0.88±0.17mm in low dose experimental group B and 0.67±0.11mm in high dose experimental group C (Table 7). It means that wall thickness of tubes of these groups differ significantly from each other at this ends (Table 8).

When individual group comparison was done it showed that at uterine end of tubes wall thickness of both experimental group from control group did not differ significantly. However the difference between wall thickness of tubes of both experimental groups at this end was significant & group B having more thick wall (Table 9).

Table 1: Thickness of walls of fallopian tubes at lateral end

Groups	Mean thickness	Std. Deviation	Maximum	Minimum
Control group A	0.80	0.11	0.96	0.64
Experimental group B	0.85	0.21	1.41	0.48
Experimental group C	0.68	0.14	0.94	0.45

Table 2: Various group comparison in thickness of walls of fallopian tubes at lateral end

	Sum of squares of thicknesses	Degree of Freedom	Mean square	Ratio of variance
Inter Groups	0.224	2	0.112	4.291
Intra Groups	1.097	42	0.026	
Total	1.321	44		

P value 0.020*

Table 3: Individual group comparison of thickness of wall of fallopian tubes (lateral end)

Groups	Groups	Mean difference of thickness	Std. error	P-value
Control group A	Group B	0.04867	0.05902	0.690
	Group C	0.11933	0.05902	0.119
Experimental group B	Group C	0.16800 *	0.05902	0.018*

Table 4: Thickness of walls of fallopian tubes in middle

Groups	Mean thickness	Standard Deviation	Maximum	Minimum
Control group A	0.81	0.10	0.99	0.66
Experimental group B	0.89	0.25	1.47	0.48
Experimental group C	0.68	0.09	0.87	0.54

Table 5: Various group comparison of thickness of walls at middle of fallopian tubes

	Sum of squares	Degree of Freedom	Mean square	Ratio of variance
Inter Groups	0.343	2	0.172	6.32
Intra Groups	1.141	42	0.027	
Total	1.485	44		

P value 0.004*

Table 6: Individual group comparison of thickness of walls of fallopian tubes (middle)

Groups	Groups	Mean difference	Standard error	P-value
Control group A	Group B	-0.08200	0.06020	0.370
	Group C	0.13017	0.06020	0.090
Low Dose Experimental Group B	Group C	0.21217 *	0.06020	0.003*

*The mean difference is significant at the .05 level.

Table 7: Thickness of walls at medial end of fallopian tubes

Groups	Mean thickness	Standard Deviation	Maximum	Minimum
Control group A	0.79	0.11	0.96	0.64
Low dose experimental group B	0.88	0.17	1.15	0.45
High dose experimental group C	0.67	0.11	0.83	0.47

Table 8: Inter group comparison of thickness of walls at medial end of fallopian tubes

	Sum of squares of thickness	Degree of Freedom	Mean square	Ratio of variance
Inter Groups	0.314	2	0.157	8.62
Intra Groups	0.764	42	0.018	
Total	1.078	44		

P value 0.001*

Table 9: Individual group comparison of thickness of walls at medial end of fallopian tubes

Groups	Groups	Mean difference	Standard error	P-value
Control group A	Group B	-0.08567	0.04925	0.203
	Group C	0.11800	0.04925	0.054
Experimental group B	Group C	0.20367*	0.04925	< 0.001*

* The mean difference is significant at the .05 level.

DISCUSSION

Monosodium Glutamate is nowadays getting very popular as food additive worldwide. In recent past it was only limited to East-Asians but now its use is increasing day by day in our society too. Although in continuous use but still questionable for its safety. Animal studies are continuously carried upon to predict its effects on various organs. Various effects such as damaging retina,[15] nervous tissue,[16] kidneys,[17] liver[18] etc. are well known. Studies on male reproductive tract resulted in oligozoospermia, atrophy of gonad, hemorrhage affecting male fertility.[19] In female reproductive organs like ovaries it is found to cause cystic degeneration and atretic follicles. Uterine fibroids were also observed due to increased levels of estrogen.[20] Recent study was planned to observe its effects on fallopian tubes- both morphological and histological aspects.

In this study wall thickness of fallopian tubes was measured from their ovarian ends, almost center/middle of tubes and from uterine ends of each tube. In each of these sections thickness was taken from base of fold to outer wall and it was done with ocular micrometer. All measurements were analyzed statistically and it was noticed that walls of fallopian tubes of low dose experimental group animals were more thick than that of control group and other high dose experimental group. These thick walls of group B can be due to the swelling of cells which is a sign of initial stages of reversible cell injury.

Cellular injury is always there where there is cellular insult whether by any sort of stress or decreased oxygenation i.e. hypoxia. MSG produces oxidative stress resulting in this injury. If cellular insult persists for longer time then it results in cellular degeneration. Cellular degeneration is basically a decline; a reversal from a high to low form. In tissues it is a decline from highly active to less active form physiologically. If unarrested this degeneration leads to cellular death which can be of two types - either apoptosis or necrosis. Both of these types of cellular deaths differ from each other in their morphology and biochemical state. One of the type is programmed i.e. Apoptosis. It is the result of activation of various self-destructive enzyme sequences in response to various stimuli leading to cell death. Second one is due to the worsening degradation by enzymes within cells resulting in morphological changes i.e., necrosis. These swollen cell ultimately ruptures resulting in an infiltration of inflammatory cells[21].

CONCLUSION

The recent study was carried out with oral doses of MSG (ajinomoto). It has been found responsible for producing changes in interstitial tissue resulting in increase in wall thickness of low dose experimental group B. These effects were observed in a minimum duration of two weeks of study and also with oral administration. Despite the fact that these effects were very limited but its use should be with care as it is possible that if given for longer duration and in increase doses it may cause more adverse changes in the fallopian tubes.

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