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Effect of Nutmeg/Vitamin C on Primary Visual Occipital Cortex in Adult Rats

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Abstract

Objective: To evaluate the neurotoxic effect of nutmeg and the protective role of vitamin C (ascorbic acid) on the primary visual occipital cortex in adult rat.

Data Sources: PubMed/Medline, Science Direct and Internet from 2010 to 2016.

Study Selection: The initial search presented 8 articles, where 2 had inclusion criteria. The articles studied the degenerative effects of nutmeg on central nervous system (CNS) and the possible neuro-protective role of vitamin C.

Data Extraction: If the studies do not meet the inclusion criteria, they were excluded.

Data Synthesis: Comparisons were made by structured review with the results tabulated. Each study was reviewed independently and the obtained data were rebuilt in new language according to the need of the researcher and arranged in topics through the article.

Findings: In total 2 potentially relevant publications were included, all were animal studies. The studies indicate the neurodegenerative effects of nutmeg on CNS and the possible neuro-protective role of vitamin C.

Conclusion: Co-treatment with vitamin C provided a beneficial role against nutmeg-induced neurotoxicity through its antioxidant property.

Keywords: Antioxidant; Apoptosis; Cerebral cortex; Neurotoxin; Nutmeg

Abbreviations: mRNA: Messenger Ribonucleic Acid; DNA: Deoxyribonucleic Acid; EBM: Evidence Based Medicine; PTZ: Pentylene Tetrazol

Introduction

Nutmeg originates from the fruit of the nutmeg tree, *Myristica Fragrans* [1]. It is best known as the kitchen spice. It enters in the composition of numerous medicines to treat gastric disorders and rheumatism [2]. Nutmeg is cheap and legal; this made it a popular narcotic among prisoners, seamen, soldiers, and struggling musicians [3]. When it is used in higher doses, it has aphrodisiac and psychoactive properties, so it received attention as an alternative hallucinogen [1]. The effects of nutmeg on CNS are variable, and reflect CNS excitatory and depressant effects [4]. Nutmeg has a pro-oxidative activity that can induce oxidative stress or inhibiting the antioxidant systems [5]. It is feasible that vitamin C has neuro-protective role as a potent scavenger of oxygen free radicals [6]. Therefore, vitamin C could be a promising candidate to antagonize the harmful effect of nutmeg on visual occipital cortex. Few studies have evaluated the effect of nutmeg on the primary visual cortex. Therefore, this work aimed at studying the effect of nutmeg on the visual occipital cortex in adult male albino rat and to establish the possible protective role of vitamin C.

Materials and Methods

Search Strategy

We reviewed papers on the impact of nutmeg on CNS and the neuro-protective role of vitamin C from PubMed/Medline, Science Direct and also materials accessible in the Internet. We used nutmeg/vitamin C/occipital cortex as searching codes. The search was accomplished in the electronic databanks from 2010 to 2016.

Study Selection

All the researches were freely evaluated for addition. They were added if they contented the following criteria:

Inclusion criteria of the published studies:

1. Published in English language.
2. Published in peer-reviewed journals.
3. Focused on nutmeg and vitamin C
4. Discussed the relation between nutmeg/vitamin C and CNS
5. If a study had several publications on definite viewpoints, we used the most recent publication giving the most related data.

Data Extraction

If the studies did not achieve the above criteria, they were omitted such as report without peer-review, not within federal studies platform, letters/comments/editorials/news and studies do not focused on the neuro- degenerative effects of nutmeg and the neuro-protective role of vitamin C.

Quality Assessment

The quality of all the studies was assessed. Important factors included, study design, attainment of ethical approval, evidence of a power calculation, specified eligibility criteria, appropriate controls, and adequate information and specified assessment measures. It was expected that confounding factors would be reported and controlled for and appropriate data analysis made in addition to an explanation of missing data. It was expected that confounding factors would be reported and controlled for and appropriate data analysis made in addition to an explanation of missing data.

Data Synthesis

A designed systematic review was accomplished with the outcomes formulated.

Results

Data Sources

PubMed/ Medline, Science Direct and Internet from 2010 to 2016.

Search Strategy

In total 8 hypothetically related publications were recognized, 6 of them was gotten from PubMed and 2 from Science Direct.

Study Selection and Characteristics

In total 8 potentially related publications were recognized, 6 articles were eliminated. A total of 2 studies were included in the review as they were considered suitable by forthright the containment criteria. All studies were animal researches. The majority of the researchers surveyed the outcomes of degenerative effects of nutmeg on CNS and the possible neuro-protective role of vitamin C.

Data Extraction

If the researches did not accomplish the above criteria, they were omitted such as commentary without peer-review, not within federal studies platform, letters/comments/editorials/update and researches not concentrated on degenerative effects of nutmeg on CNS and the possible neuro-protective role of vitamin C. The considered publications were assessed to evidence-based medicine (EBM) criteria by means of the classification of the U.S. Preventive Services Task Force & UK National Health Service protocol for EBM in addition to the Evidence Pyramid

U.S. Preventive Services Task Force:

a) Level I: Evidence obtained from at least one properly designed randomized controlled trial.

b) Level II-1: Evidence obtained from well-designed controlled trials without randomization.

c) Level II-2: Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.

d) Level II-3: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.

e) Level III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Data Synthesis

A designed systematic review was accomplished with the outcomes formulated.

Quality Assessment

Vital issues encompassed, study design, fulfilment of ethical approval, evidence of a force estimation, definite eligibility norms, and suitable controls, enough data, and definite assessment manners were evaluated.

Effect of Nutmeg / Vitamin C on Primary Visual Occipital Cortex in Adult Rats

One study (Table 1) stated nutmeg induced neurodegenerative and apoptotic effects as apoptotic nuclei on adult rat lateral geniculate body which is a part of visual pathway.

One study (Table 1) [24] stated that there was a beneficial effect of vitamin C on the degenerative changes caused by neurotoxic agents on the cerebral cortex in adult rats.

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Table 1: Comparison between the selected two studies.

Author Name	Type of Study	Findings	Evidence Need to be Inserted	Level and Type of Evidence
Adjene JO, Igbigbi PS [10]	Review article	Orally nutmeg treated lateral geniculate body in adult rat model showed some cellular degenerative changes like pyknotic nuclei with some microcystic changes and vacuolations in the stroma by histological study, as compared to that of the control group.	Treatment with nutmeg in high doses and for long period had neurotoxic and apoptotic effects on the neuronal cells of the lateral geniculate body of adult rats, that may affect visual sensibility functions of the lateral geniculate body	Level Ia (Evidence obtained from meta-analysis of randomized controlled trials)
Afifi OK, Saleh A [24]	Review article	Co-treatment with ascorbic acid in cadmium treated rats showed improvement by histological and morphometric studies, in many layers the nerve cells as pyramidal and granular cells were more or less as that of control group.	Co-treatment with ascorbic acid exhibited an ameliorating effect on the Cadmium induced cerebral cortical neuro-toxicity in an experimental model of adult rats, prevented by free radical scavengers or antioxidative property of ascorbic acid	Level Ia (Evidence obtained from meta-analysis of randomized controlled trials)

Discussion

As the primary visual occipital cortex is the best-studied visual area in brain. It is the simplest and the earliest cortical visual area. In addition, it is highly specialized for handling information about static, moving objects, and plays an important role in pattern recognition [7]. Nutmeg is considered particular neurotoxic food additive, in such a way, as to cause damage to nervous tissue [8]. Since it has been widely used, as a spice in various dishes [9]. Studies on nutmeg were done. One of them reported that nutmeg induced visual hallucination. This effect could be mediated by affecting the visual pathway, through affecting the microanatomy of the lateral geniculate body of adult rats [10,11].

A study demonstrated that, there were cellular degenerative changes as pyknotic nuclei and some microcystic changes in the stroma of the superior colliculus-treated with nutmeg [12]. In addition, there was another study which conducted that, cellular degenerative changes in the nutmeg-treated medial geniculate body were found [13]. Moreover, nutmeg toxicity is not only reported to affect the nervous system, but also its toxicity extents to include other organs in the body. It was recorded that, high doses of nutmeg had deleterious effects on the kidneys of adult rats [14]. Although the neurotoxic effect of nutmeg in the visual hallucinations associated with over dose. This means that, in low doses, nutmeg produces no noticeable physiological or neurological response, but in large doses, raw nutmeg has psychoactive effects [15].

Nutmeg was reported to have cytotoxic and apoptotic effects in a mechanism, involving messenger ribonucleic acid (mRNA) down regulation [16]. Caspases are the enzymes which involved in breakdown of deoxyribonucleic acid (DNA) into fragments. These fragments of DNA are important in detecting apoptotic cells by agarose gel electrophoresis [17]. Damaged neurons induced also astrogliosis. So astrogliosis has been used as an index for underlying neuronal damage [18]. It was demonstrated that nutmeg extracts showed pro-oxidative activity that stimulated oxidative stress [19]. So this side effect could be overlapped by antioxidants. Antioxidant is a molecule stable enough to donate an electron to a rampaging free radical and neutralize it. They can safely interact with free radicals and terminate the chain reaction before vital molecules are damaged [20]. Since vitamin C is considered the major water-soluble antioxidant within the body and can pass blood brain barrier [21]. Preclinical trials showed a beneficial effect of vitamin C on the degenerative changes caused by nutmeg on brain. Vitamin C prevented some of the deleterious effect of ethanol on developing rat brain when given after ethanol exposure [22].

Co-treatment of vitamin C showed significantly decreased expression of caspase-3 as compare to control group. Vitamin C had protective effect against pentylenetetrazol (PTZ) -induced apoptotic neuro-degeneration in adult rat brain [23]. Moreover, vitamin C (ascorbic acid) can ameliorate the histological degenerative apoptotic changes induced by cadmium on the cerebral cortex of rats [24]. Vitamin C, as compared to other antioxidant drugs, exerts potent anticonvulsant and neuro-protective effects [25]. The before mentioned studies direct the attention to the antioxidants as vitamin C as protective measures for the neurotoxicity induced by nutmeg. The body cannot manufacture vitamin C, so they must be supplied in the diet [20].

Conclusion

Constructed on the results offered, this study co-treatment with vitamin C provided a beneficial role against nutmeg-induced toxicity through its antioxidant property.

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