EFFECT OF CONTINUOUS INTAKE OF MICROWAVE EXPOSED MICE FEED ON THE TESTICULAR GLYCOGEN AND SEMINAL VESICULAR FRUCTOSE OF SWISS ALBINO MICE

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ABSTRACT

Scientific development has increased human dependence on electronic gadgets. Maximum available electronic gadgets produce electromagnetic radiation. We are exposed to array of electronic gadgets like Microwave oven, radar, mobile phones, television, computer, electric blankets etc in our daily routine. Microwaves are electromagnetic waves with wavelengths ranging from as long as one meter to as short as one millimeter. In the study the male swiss albino mice were given food pellets (containing wheat, soya, maize, cannula, roasted black gram and other essential ingredients). These pellets were heated in microwave oven at frequency 320 watt for 10 mins. The fixed amount of food as dose was given as their normal dietary intake for 2 weeks, 3 weeks and 4 weeks after which autopsies were performed. Animals were divided into 3 groups namely Experimental, Control, and Sham . It was observed that the level of testicular glycogen and seminal vesicular fructose decreased in experimental and as compared to control. The present study suggests that microwave cooked food leads to lowering of fructose and glycogen in experimental. Fructose in semen reflects the secretary function of seminal vesicle. There is a decline in the level of fructose in the experimental group of animals, thus contributing to the low semen quality . Decreased level of glycogen inhibits spermatogenesis. The result of the study is applicable if animal continuously intakes only microwave exposed food.

Keywords: Microwave food, Glycogen, Fructose, Spermatogenesis.
INTRODUCTION
Microwave ovens have effects on the food heated or cooked and on the people who ingest food that is exposed to microwave radiations. As per Russian investigations published by the Atlantis Rising Educational Center in Portland, Oregon carcinogens were formed in virtually all foods tested. No test food was subjected to more microwaving than necessary to accomplish the purpose. [1] Microwave ovens heat food through a process of creating molecular friction, but this same molecular friction quickly destroys the delicate molecules of vitamins and phytonutrients (plant medicines) naturally found in foods. Becker [2,3] described research of the Russians on the health effects of microwave radiation, which they called microwave sickness which includes increased incidence of appendicitis, cataracts, reproductive problems, and cancer. George et al [4] showed that microwaves cause a higher degree of "protein unfolding" than conventional heating. Microwave exposed food continuous feeding cause’s recoverable changes in testosterone level [5]. It was reported by Singhal et al[6] that the administration of testosterone increases the glycogen content of the rat prostate. Testosterone is time-related with the decrease in glycogen stores,[7]. Glycogen serves as an important energy source for the testes during fetal development. The glycogen metabolism forms an important pathway for energy production in growing rats. The halving of the number of chromosomes in the process of spermatogenesis provides an interesting model for the investigation of a developmental process involving structural and metabolic changes in the germ cells. It is well known that the spermatogonia may utilise glucose as the major energy substrate [8], but spermatocytes and spermatids suffer a rapid decline in their ATP content in glucose supplemented media and require lactate/pyruvate for the maintenance of their ATP concentrations [9,10]. In contrast, spermatozoa use glucose/fructose as the major source of energy [11]. Therefore, it appears that, at each stage of spermatogenesis, there is a change in the substrate required for energy.[12]

Bajpai et al [12] reported that the equilibrium between glycolysis and the TCA cycle shifts more in favour of oxidative metabolism in post-meiotic germ cells. Thus the ratio of glycolysis to TCA cycle activity is likely to be greater in spermatocytes than in spermatids. However, in spermatozoa the equilibrium again shifts drastically in favour of glycolysis. The rate of glycolysis and lactate production in situ is under fine regulation to maintain a steady-state concentration of lactate in the spermatogenic microenvironment. Thus the survival of the advanced germ cells in testis is strictly dependent on carbohydrate metabolism, including both anaerobic (glycolysis) and aerobic (TCA cycle) pathways. The sugars are actively
glycolysed by the Sertoli cells, which secrete lactate as the major energy substrate for spermatocytes and spermatids.

The germ cells use the TCA cycle preferentially over glycolysis; however, all the testicular germ cells do not rely on oxidative metabolism: spermatogonia may depend more on glycolysis, spermatocytes are intermediate and can depend to some extent on glycolysis, whereas spermatids use the TCA cycle exclusively for their energy. However, interestingly, spermatozoa again regain the ability to utilize glucose/fructose [9-12]. Therefore, during spermatogenesis, the dependence of germ cells on lactate/pyruvate and glucose for energy metabolism keeps changing. The main function of fructose is to supply the life energy to the spermatozoa in the form of an easily glycolyzable material.[13] Sperm obtained directly from the epididymis contains hardly any fructose. During the passage through the male generative tract the semen acquires fructose from the accessory glands of reproduction, of which the seminal vesicles are the chief contributors of fructose. Glucose is first phosphorylated by adenosinetriphosphate and the monophosphohexose thus formed is further metabolized through diphosphofructose, phosphotriose, phosphoglyceric acid and pyruvic acid to lactic acid. [14]

**MATERIAL AND METHOD**

Sexually mature male mice (*Mus musculus*) weighing between 25 to 30 g were randomly selected. They were housed separately in plastic cages under controlled condition of temperature and light. The animals were divided into 3 groups Control, Sham and Experimental. The experimental mice were given food pellets (Hindustan Lever Pvt. Ltd.) exposed in microwave at 320°watt for 10 minutes. The sham group was given the normal food in low quantity whereas control was given normal food in sufficient amount. The experimental group was administered with fixed amount of microwave cooked mice pellets daily for 2 week (Experiment 1), 3 week (Experiment 2), 4 weeks (Experiment 3). The recovery group (Experiment 4) was given the microwave pellets for 4 weeks and after that they were given normal mice fed for 4 weeks. After the termination of each of experimentation group, the treated and control males were sacrificed by cervical dislocation. Quantitative concentration Fructose was estimated by Seliwanoff test[15] in seminal vesicle. Glycogen was estimated quantitatively in testis by method of Montogomery [16] in testis.
RESULTS
The level of glycogen (Table I) and fructose (Table II) declines significantly with increasing duration of microwave exposed food administration in experimental group as compared to control. The 4 week recovery experimental group shows significant recovery. The sham group exhibit disturbed metabolism with irregular pattern of rise and fall level of glycogen.

Table I: Effect on Glycogen Concentration in Testis of Swiss Albino Male Mice fed on Food Exposed to Microwave Radiations.

<table>
<thead>
<tr>
<th>AUTOPSY INTERVAL</th>
<th>CONTROL (mg/gm tissue taken)</th>
<th>SHAM</th>
<th>EXPERIMENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 WEEK</td>
<td>42±2.12</td>
<td>46.2±6.06**</td>
<td>12±3.92**</td>
</tr>
<tr>
<td>3 WEEK</td>
<td>39.6±1.99</td>
<td>56.4±5.9*</td>
<td>37.8±4.3**</td>
</tr>
<tr>
<td>4 WEEK</td>
<td>44±9.3</td>
<td>41.4±2.9*</td>
<td>32 ±3.2 **</td>
</tr>
<tr>
<td>4 WEEK RECOVERY</td>
<td>34.2±5.17</td>
<td>51.6±0.58**</td>
<td>38.2±3.09*</td>
</tr>
</tbody>
</table>

Significance in relation to control*p<0.05, **p<0.01

Table II: Effect on Fructose Concentration in Seminal Vesicle of Swiss Albino Male Mice fed on Food Exposed to Microwave Radiations.

<table>
<thead>
<tr>
<th>AUTOPSY INTERVAL</th>
<th>CONTROL (mg/gm)</th>
<th>SHAM</th>
<th>EXPERIMENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 WEEK</td>
<td>21.88±1.7</td>
<td>3.56±1.17**</td>
<td>2.54±0.59**</td>
</tr>
<tr>
<td>3 WEEK</td>
<td>16.42±1.56</td>
<td>5.904±0.35**</td>
<td>4.9±0.62**</td>
</tr>
<tr>
<td>4 WEEK</td>
<td>20.18±0.95</td>
<td>4.06±1.05**</td>
<td>3.26±0.60*</td>
</tr>
<tr>
<td>4 WEEK RECOVERY</td>
<td>12.448±1.61</td>
<td>8.36±0.74*</td>
<td>21.54±1.79**</td>
</tr>
</tbody>
</table>

Significance in relation to control*p<0.05, **p<0.01

DISCUSSION
Leiderman & Mancini [17] reported the relationship between the glycogen content and gonadal maturation. Glucose has also been shown to be an essential substrate for maintaining tissue integrity, ATP production and protein synthesis in the rat testes [18-21]. The availability of glucose in the testes is, in turn, naturally dependent on the degradation of
glycogen. The glycogen content in the cell indicates energy storage. Sertoli cells and spermatogonia often contain glycogen where it serves to provide reserve of carbohydrates for seminiferous tubular cells.

Depletion in testicular glycogen was possibly attributed to the decreased number of post-meiotic germ cells [22]. Glycogen decreased in could be due to blockage of androgen and spermatogenesis. Reduced glycogen reflects decreased number of post-meiotic germ cells, which are thought to be the sites of glucose metabolism [23]. The low glycogen content in the testis after microwave exposed food administration is possibly due to the inhibition of phosphorylase activation or the depletion of certain other enzymes which could block androgen synthesis[24,25]. A fall in glycogen level may be due to interference in glycogenolysis. Since glycogen is an energy source for general metabolism and constant supply of glucose is essential for proper functioning of testes,[26] A fall in glycogen level may be due to interference in glucose metabolism. The induced inhibition of glycolytic enzymes may affect the maturational process of spermatozoa and their motility. Inhibition of glycogen synthesis eventually decreases spermatogenesis process .[27]

Reduction in the fructose concentration in the seminal vesicle might be the result of a decreased secretory activity [28]. Low fructose concentration may be another cause of low sperm motility. Chinoy and Bhattacharya[29] reported reduced sperm motility after aluminium chloride administration in mice with decreased seminal vesicular fructose, as the latter supplies energy for sperm motility. The lower fructose concentration always suggested a decrease testosterone production by the Leydig cells, when there was no sign of inflammation of the prostate region or seminal vesicles.[30] The testosterone levels declines significantly with increasing duration of food administration (microwaved) in animal fed with microwave exposed food.[5] Thus continuous intake of microwave exposed food adversely affect testicular glycogen and seminal fructose, thereby affecting energy metabolism of sperm. The result of the study is applicable if animal continuously intakes only microwave exposed food.

REFERENCES


