EFFECT OF ALCOHOL ON MALE REPRODUCTIVE HORMONES


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ABSTRACT

Alcohol affects the endocrine gland and hormone involved in the male reproduction. Alcohol intake is associated with low testosterone level and also the low production of LH and FSH level. The lower level of these hormones affects the reproductive hormones and may affect reproductive function adversely work as a causative factor for infertility. 300 samples were taken for the study and the testosterone, luteinizing hormone (LH) and follicle stimulating hormones (FSH) were investigated in alcoholism. The statistical evaluation of markers will confirm these observations. The results of this study show the alcohol intake lowers the LH, FSH and testosterone activity. The lower level lowers the sperm count.

KEY WORDS: LH, FSH, Testosterone, Alcoholism.

Introduction:

Drinking alcohol affects the body’s reproductive system - the hypothalamus in the brain, the pituitary gland and the testes. The male reproductive system consists of three parts: a brain region called the hypothalamus, the anterior pituitary (a gland that is located at the base of the brain but is not considered a brain region), and the testes. The hypothalamus and the anterior pituitary gland have solely regulatory functions, which are mediated by the hormones secreted from these two organs. The third component, the testes also produces key hormones controlling male sexual characteristics and behaviors, the most important of which is testosterone. In addition, the testes are responsible for sperm production (2).

Among other hormones, the hypothalamus produces gonadotropin releasing hormone (GnRH). In response to the GnRH stimulus, the anterior pituitary gland produces two hormones that control reproductive functions — luteinizing hormone (LH) and follicle-stimulating hormone (FSH) and releases them into the general circulation. Those two hormones have different functions in men and women (4).
The hypothalamic-pituitary-gonadal axis is a complex system involving feedback from the target organs, the gonads (i.e., the testes and ovaries), to the hypothalamus, where a key reproductive hormone, luteinizing hormone releasing hormone (LHRH), is released into the portal blood system. Upon reaching the pituitary gland, LHRH attaches to specific receptors and activates a complicated cascade of biochemical events that results in the synthesis and release of the two gonadotropin hormones, luteinizing hormone (LH) and follicle-stimulating hormone (FSH). LH is largely responsible for gonadal production of androgens, which are hormones that have masculinizing effects (e.g., testosterone). FSH is important for normal development and maturation of sperm in the male and ovarian follicles in the female. The gonadal hormones—including testosterone in the male circulate back to the hypothalamic-pituitary unit and encourage or discourage further release of LHRH, LH, and FSH in a finely tuned system (3).

Materials and Methods:

300 subjects were participated in the study. Subjects were selected by the physician among persons with an identified alcoholism from Shanthi social service Center, Coimbatore, Tamilnadu. All subjects were interviewed using a questionnaire with regard to alcohol intake and drinking habits. They were also asked to answer a questionnaire form including age, the family History of alcoholism, the amount and kind of alcohol they consume. All subjects signed an informed consent to participate in this study. All were in the age groups between 18-70. Based on the age groups 200 alcoholic subjects were divided in to five groups as Group I: 18-30, Group II: 31-40, Group III: 41-50, Group IV: 51-60, and Group V: 61-70. 100 subjects (all men, age 18-70 years) were totally abstinent of alcohol (Control) also divided in to five groups.

Venous blood samples were collected in the plain tubes. The blood samples were centrifuged to obtain the clear supernatant (serum) and the supernatant were stored at -18°C. With the serum, LH, FSH and Testosterone were estimated (8,9,10) and calculated.

Statistical analysis:

All Hormonal analysis was performed with the one way ANOVA. The results obtained were expressed as Mean ± Standard deviation (SD). For all comparisons, a p value ≤ 0.05 was considered statistically significant.

Results:

Effect of Alcohol on Reproductive Hormones:

The LH concentration was significantly altered in patients consuming alcohol for all the groups (Groups I to Group V) (p<0.05) as compared to the control subjects. The LH activity lowers in the five groups than that of control groups which was shown in the Table 1.
Table 1: Effect of alcohol in LH activity

<table>
<thead>
<tr>
<th>Groups</th>
<th>Alcoholics n=200</th>
<th>Control n=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.66±0.27*</td>
<td>5.5±2.0*</td>
</tr>
<tr>
<td>II</td>
<td>0.67±0.27*</td>
<td>5.3±2.5*</td>
</tr>
<tr>
<td>III</td>
<td>0.64±0.28*</td>
<td>5.5±1.4*</td>
</tr>
<tr>
<td>IV</td>
<td>0.53±0.22*</td>
<td>5.0±5.2*</td>
</tr>
<tr>
<td>V</td>
<td>0.58±0.25*</td>
<td>5.1±1.7*</td>
</tr>
</tbody>
</table>

*Values are mean ± SD  
*p<0.05

Table 2 shows the activity of FSH compared to control subjects respectively. FSH was significantly lower (p<0.05) in all the five groups of subjects consuming alcohol as compared to the control subjects.

Table 2: Effect of alcohol in FSH

<table>
<thead>
<tr>
<th>Groups</th>
<th>Alcoholics n=200</th>
<th>Control n=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.73±0.26*</td>
<td>10.2±4.9*</td>
</tr>
<tr>
<td>II</td>
<td>0.66±0.23*</td>
<td>7.7±3.3*</td>
</tr>
<tr>
<td>III</td>
<td>0.59±0.27*</td>
<td>8.4±4.3*</td>
</tr>
<tr>
<td>IV</td>
<td>0.57±0.30*</td>
<td>11.0±4.6*</td>
</tr>
<tr>
<td>V</td>
<td>0.53±0.24*</td>
<td>11.8±5.2*</td>
</tr>
</tbody>
</table>

*Values are mean ± SD  
*p<0.05
The testosterone level was represented in the table 3. It shows the lower level of testosterone activity in all the five groups. The testosterone level was significantly lower (p<0.05) than that of control subjects.

Table 3: Effect of alcohol in Testosterone

<table>
<thead>
<tr>
<th>Groups</th>
<th>Alcoholics n=200</th>
<th>Control n=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>158.7±26.4*</td>
<td>589.2±191.3*</td>
</tr>
<tr>
<td>II</td>
<td>173.7±20.6*</td>
<td>660.7±226.7*</td>
</tr>
<tr>
<td>III</td>
<td>158.6±31.3*</td>
<td>606.8±215.3*</td>
</tr>
<tr>
<td>IV</td>
<td>164.7±22.5*</td>
<td>577.8±219.8*</td>
</tr>
<tr>
<td>V</td>
<td>172.3±23.3*</td>
<td>688.0±146.4*</td>
</tr>
</tbody>
</table>

#Values are mean ± SD * p<0.05

Discussion:

Reduction in the serum testosterone could be due to decreased synthesis. As testosterone levels decrease, levels of LH and FSH would increase to stimulate the production of more testosterone(6). But in our study we found that low serum testosterone level in all the age groups of alcoholics were accompanied by low serum LH and FSH levels. This finding suggests that the hypothalamic cells, which produce luteinizing hormone releasing hormone (LHRH), do not function correctly to the feedback when testosterone level decreased. The inability of the pituitary gland to respond appropriately to a decline in testosterone implies that alcohol has a central effect on the interaction between the nervous system and endocrine system. The decrease in gonadotropin levels results from impairment in both production and secretion. It might be due to the effect not only on the pituitary gland but also on the hypothalamus (7).

Alcohol lowered testosterone levels. Heavy drinkers (without liver disease) have significantly lowered sperm counts, sperm motility and free testosterone. By the way, alcohol does not just affect testosterone but growth hormone levels as well.

The short term reason for low level was that acetylaldehyde, the primary breakdown product of ethanol (alcohol), acts on the Leydig Cells directly to reduce testosterone production. Even small dosage
levels affect testosterone production in Leydig cells, a very bad sign indeed. The drop in testosterone can even be more severe in those with depleted Vitamin E levels.

Alcohol lowers testosterone through four key mechanisms: 1) an increase in the opioid beta-endorphin, 2) a reduction in testicular nitric oxide, 3) oxidative damage, 4) cell damage (from increased oxidation). All of these pathways will lower testosterone and explain why alcohol is such a potent testosterone lower, especially in those who drink more than moderately (1).

In addition to reducing LH levels in the blood, alcohol may affect the activity of the LH molecule, rendering it less capable of stimulating hormone production in the testes. Like many other hormones, LH is not a simple protein but a protein to which various carbohydrates are attached (i.e., glycoprotein). The number and types of carbohydrates attached to the protein determine the hormone's ability to stimulate testosterone production (i.e., its biological potency). Numerous LH variants exist with differing attached carbohydrates and differing potencies. Alcohol has been shown to result in the production of less potent LH molecules. Therefore, alcohol's deleterious effects on LH function are qualitative as well as quantitative (1).

Decreased production of sex hormones principally testosterone is characterized by a loss of male secondary sex characteristics, impotence, diminished libido, and other symptoms, but usually not by an obvious reduction in testicular size. Chronic alcohol consumption affects both testicular functions, which produces sexual dysfunction and impairs sperm production (3).

Conclusion:

In the reproductive hormones LH, FSH and testosterone plays a vital role in the male reproductive system. Heavy drinking affects the LH and FSH level. The LH, FSH and testosterone shows the lower activity alcoholics than that of control subjects of all the age groups. The lower activity lowers the sperm count.

...Alcohol hasa harmful effect in all the levels of male reproductive system. The effect of alcohol intake during the pubertal and prepubertal affects the reproductive organs. In future such investigations may be pioneers to identifyin detail. Research studies are needed to clarify such issues.

References: