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Alcohol Consumption Is Associated with Hypogonadism and Decreased Sexual Function in Ghanaian Diabetics

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Abstract

Introduction: Alcohol usage has largely been seen as a risk factor for the development of sexual dysfunction as well as erectile dysfunction. Others have reported that prolonged alcohol usage and abuse is compatible with normal sexual function in the absence of endocrinological problems as well as hepatic dysfunction. About seventy five (75) percent of alcoholics have various sexual difficulties with improvements in sexual functions occurring after treatment of alcoholism and psychosexual therapy. It is evident from the various reports over the years that mild and occasional alcohol usage is not as much implicated in the causation of SD and its other forms as heavy, addictive or dependent alcohol usage. Alcohol usage has also long been linked to hypogonadism, testicular atrophy as well as leydig cell toxicity. Alcohol induced hypogonadism has been reported to resolve after withdrawal of alcohol use. Since both diabetes and alcohol usage have been strongly associated with both hypogonadism and sexual dysfunction, it is logical to expect that diabetics who frequently consume alcohol will have a worsened hypogonadal state and sexual function. This research therefore seeks to provide evidence of an association between alcohol consumption in diabetics and a worsened sexual dysfunction in comparison to diabetics who did not consume alcohol. **Methods:** Type II diabetic patients attending the Diabetic Clinic at the Maamobi General Hospital between the periods of January 2010 and March 2011 were consecutively recruited for this study. Diabetics with other known endocrinological diseases

and physical disabilities were excluded from the study. Sexual function was assessed using the GRISS-M. Early morning fasting samples were used in lipid and testosterone profile assays. **Results:** Study participants who consumed alcohol recorded higher levels of triglycerides and LDL-Cholesterol. They also recorded significantly lower levels of bioavailable testosterone. Furthermore they also recorded higher scores for impotence, premature ejaculation, non-sensuality and infrequency but lower scores for avoidance and were about six times more likely to be infrequent in their sexual activity in comparison with those who did not consume alcohol. **Conclusion:** Alcohol consumption among diabetic males is associated with hypogonadism and has an impact on several domains of male sexual function. Diabetic males should be advised to avoid alcohol abuse in order to facilitate the management of diabetes associated sexual dysfunction.

Keywords

Hypogonadism, Sexual Dysfunction, Erectile Dysfunction, Libido, Alcohol Abuse

1. Background

The advertisement and consumption of alcoholic products in Ghana and the world over is a serious business thus any issue associated with alcohol usage is very sensitive. However, several evidences have been presented on the impact of alcohol usage on diabetes [1], sexual dysfunction (SD) [2] and erectile dysfunction (ED) [3] [4]. Alcohol usage has largely been seen as a risk factor for the development of erectile dysfunction [5], but some few studies have reported alcohol usage not as a risk factor [4] [6] but rather having a modestly negative association [6] [7] with ED with some suggesting there is no justification for asking men who took acceptable levels of alcohol to reduce or stop their habit [6]. Other researchers however have presented alcohol consumption as being beneficial to erectile function [8], causing improvements in libido [9], decreasing prevalence of ED [10] [11] and inversely related to risk of ED [12] whiles others associate alcohol consumption with an increased prevalence of ED. Prolonged alcohol usage and abuse have been reported to be very compatible with normal sexual function in the absence of endocrinological problems as well as hepatic dysfunction [13].

The impact of alcohol usage on cognitive function is well documented [14], with other studies reporting that mild alcohol usage breaks the anxiety barrier and promotes sexual activity [15]. Other reports have presented the usage of red wine as having cardiometabolic benefits and decreasing the risk of cardiovascular disease [16]. Largely, among patients that abuse alcohol, sexual dysfunction is frequently reported and may be in part related to a central nervous system dopamine deficiency. The abuse of these substances is taught to alter serotonin, acetylcholine, as well as other neuroendocrine functions. Alcohol-induced SD

seems to resolve spontaneously with abstinence in the majority of cases [17]. Alcoholics have been reported to have higher prevalence of SD with some research reporting that three quarters of alcoholics have various sexual difficulties [18] with improvements in sexual functions after treatment of alcoholism [18] and psychosexual therapy in recovering alcoholics [19]. It is evident from the various reports over the years that mild and occasional alcohol usage is not as much implicated in the causation of SD and its other forms as heavy, addictive or dependent alcohol usage.

Alcohol consumption has also long been linked to hypogonadism [20] [21] [22] testicular atrophy [23] as well as leydig cell toxicity and failure [24], thus alcoholics are likely to have a higher prevalence and risk of developing hypogonadism than non-alcoholics. Alcohol induced hypogonadism has been reported to reverse after withdrawal of alcohol use [25]. Postulated mechanisms of action include effects of ethanol on leydig cell mitochondrial function. The possible mechanisms as earlier put forward by Yu-Bin Chiao and his colleagues [20] include alcohol-enhanced metabolism of testosterone as a result of ethanol induced increases in testosterone 5-α-reductase activity and aromatase activity leading to increased metabolism of testosterone and its conversion to estrogens.

Since diabetes mellitus and alcohol usage have been strongly associated with both hypogonadism and sexual dysfunction, it is logical to expect that diabetics who frequently consume alcohol or are dependent on alcohol will have a worsened hypogonadal state and sexual dysfunction. This research therefore seeks to provide evidence of an association between alcohol consumption in diabetics and a worsened sexual dysfunction in comparison to diabetics who did not consume alcohol.

2. Methods

Type II diabetic males who attended the Diabetic Clinic at the Maamobi General Hospital between the periods of January 2010 and March 2011 were consecutively recruited for this study. The participants numbering a total of 148 had to be at least 18 years old and engaged in a two year stable heterosexual relationship. Diabetics with other known endocrinological diseases and physical disability were excluded from the study. An informed and signed consent to partake in this study was obtained from each participant before enrolment into the study. The Committee on Human Research Publication and Ethics (CHRPE) of the School of Medical Science and the Komfo Anokye Teaching Hospital (KATH), Kumasi, gave prior ethical approval for this study. Study participants were categorized into those who did consume alcohol and those who did not consume any alcohol product per week. Hypertension was diagnosed by either a self-reported hypertension on hypertensive medications or a blood pressure greater than 130/90 mmHg. Sexual function was assessed using the Golombok Rust Inventory of Sexual Satisfaction for males (GRISS-M). The GRISS-M is a 28 item questionnaire used for assessing the presence and severity of sexual problems in heterosexual couples or individuals engaged in heterosexual relationships. It is

structured on a five-point (Likert type) scale with answers ranging from "always", "usually", "sometimes", and "hardly ever" and "never". It is useful in providing overall scores of sexual function plus subscale of impotence, premature ejaculation, infrequency, non-communication, dissatisfaction, non-sensuality and avoidance. The total and subscale raw scores are transformed into a standard nine point scale, with higher scores indicating greater problems. SD is indicative for scores of five or more. The reliability of the overall scales has been validated [26]. An early morning fasting blood samples was collected from participants between the morning hours of 6:00 to 8:00 GMT and was used in lipid profile and testosterone profile assays. All lipid profile assay were determined using the JAS Diagnostics® reagent kits on the BT 5000® Random Access Chemistry Analyzer (Biotecnica, Italy). The Total and Free Testosterone assay were estimated using the Elabscience® reagent kits on the AxSYM automated analyzer (Abbott Diagnostics, USA)whilst the Bioavailable Testosterone levels was calculated using the Sodergard equation [27]. The methods adopted in the assay process were according to the reagent manufacturers' guidelines. Diabetic participants were consecutively sampled until the sample size estimate (148) based on statistical power calculation was obtained. The number of alcohol consuming diabetics within that population was considered a fair representation of alcohol consuming diabetics within the general population.

3. Statistical Analysis

Sigma plot for windows, version 11.0 systat, Inc. Germany and GraphPad version 5.0, San Diego California, USA were used in all the analysis. The data was presented as mean ± SD. In all the statistical analysis, a value of $p < 0.05$ was considered to be significant. All data sets passed the normality testing using the D'Agostino and Pearson omnibus normality test.

4. Results

The mean Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Body Mass Index (BMI) and Waist-to-Hip ratio (WHR) for the participants in this study were 158.34 ± 25.33 mmHg, 101.63 ± 14.91 mmHg, 28.93 ± 7.32 $kg{\cdot}m^{-2}$ and 0.93 ± 0.06 respectively. The mean Total Cholesterol (TCHOL), Triglycerides (TRIG), HDL-Cholesterol (HDL) and LDL-Cholesterol (LDL) for the study participants were 4.56 ± 1.32 mmol/l, 0.95 ± 0.08 mmol/l, 1.40 ± 0.10 mmol/l and 2.81 ± 0.55 mmol/l. There was no difference in the SBP, DBP and BMI when participants who consumed alcohol were compared to those who did not consume alcohol. There was also no difference in the Total Cholesterol and HDL-Cholesterol levels when the same groups were compared. However participants who consumed alcoholic products recorded higher levels of triglycerides and LDL-Cholesterol when compared to those who did not consume alcohol (**Table 1**).

The mean Total, Free and Bioavailable Testosterone levels were 3.89 ± 0.43 $ng{\cdot}ml^{-1}$, 0.11 ± 0.02 $ng{\cdot}ml^{-1}$ and 3.75 ± 0.32 $ng{\cdot}ml^{-1}$ respectively. Participants who consumed alcohol did not record any differences in their total testosterone

Table 1. Cardiometabolic & lipid profile of alcohol and non-alcohol consuming participants.

Variable	Total (N = 148)	No Alcohol (N = 102)	With Alcohol (N = 46)	P-value
CARDIOANTHROPOMETRY				
SBP (mmHg)	158.34 ± 25.33	156.72 ± 12.73	160.52 ± 11.38	0.4831
DBP (mmHg)	101.63 ± 14.91	101.4 ± 10.54	102.4 ± 8.33	0.7629
BMI (kg/m^2)	29.76 ± 5.43	26.69 ± 3.75	28.13 ± 4.61	0.3329
WHR	0.93 ± 0.06	0.93 ± 0.04	0.94 ± 0.01	0.7603
LIPID PROFILE				
TCHOL (mmol/l)	4.56 ± 1.32	4.60 ± 0.13	4.43 ± 0.22	0.5436
TRIG (mmol/l)	0.95 ± 0.08	0.88 ± 0.05	1.14 ± 0.10	0.0186
HDL (mmol/l)	1.40 ± 0.10	1.38 ± 0.05	1.52 ± 0.08	0.2556
LDL (mmol/l)	2.81 ± 0.55	2.79 ± 0.09	2.91 ± 0.20	0.0469

SBP-Systolic Blood Pressure, DBP-Diastolic Blood Pressure, BMI-Body Mass Index, WHR-Waist-to-Hip Ratio.

and free testosterone levels, but recorded significantly lower levels of bioavailable testosterone in comparison to those who did not consume alcohol. The mean scores for SD, Impotence, Premature ejaculation, Non-sensuality, Avoidance, Dissatisfaction, Non-communication and Infrequency recorded for the study participants were 5.00 ± 1.21, 4.98 ± 1.04, 4.66 ± 1.06, 5.15 ± 1.56, 4.64 ± 1.22, 4.81 ± 1.04, 5.12 ± 1.37 and 4.73 ± 0.97 respectively. When the participants who consumed alcohol were compared to those who did not consume alcohol, those who consumed alcohol recorded higher scores for impotence, premature ejaculation, non-sensuality and infrequency but lower scores for avoidance (Table 2).

Participants who consumed alcohol did not record any independent risk of developing sexual dysfunction or any of the subscales except for infrequency where participants who consumed alcohol were about six times more likely to be infrequent in their sexual activity in comparison with those who did not consume alcohol (Table 3).

5. Discussion

Participants who consumed alcohol recorded higher levels of triglycerides and LDL-cholesterol, key components in the biochemical process of atherosclerosis and endothelial damage. Continuous alcohol usage could induce hypogonadism either by direct injury to leydig cells or the increased aromatization of testosterone to estrogenic intermediates. As both the formation of atherosclerotic lesions and endothelial dysfunction are enhanced by the alcohol induced dyslipidemia as well as alcohol induced hypogonadism, diabetics who consume alcohol eventually develop a double barreled enhancement of endothelial dysfunction which eventually could markedly compromise the availability of NO and also potentially overwhelm free radical scavengers, causing an increased levels of oxidative stress and compromising the availability of endothelial NO. This

Table 2. Hypogonadism & Sexual dysfunction in alcohol and non-alcohol consuming participants.

Variable	Total (N = 148)	No Alcohol (N = 102)	Yes Alcohol (N = 46)	P-value
MARKERS OF HYPOGONADISM				
Total Testosterone (ng/ml)	3.89 ± 0.43	3.17 ± 0.75	0.55 ± 0.01	0.0768
Free Testosterone (ng/ml)	0.11 ± 0.02	0.13 ± 0.03	0.02 ± 0.00	0.0957
Bioav. Testosterone (ng/ml)	3.75 ± 0.32	2.95 ± 0.71	0.49 ± 0.09	0.0394
SEXUAL FUNCTION				
SD	5.00 ± 1.21	5.00 ± 1.18	5.00 ± 1.39	0.8977
IMP	4.98 ± 1.04	4.60 ± 1.16	5.36 ± 1.35	0.0418
PE	4.66 ± 1.06	4.56 ± 1.15	5.91 ± 1.39	0.0050
NS	5.15 ± 1.56	4.71 ± 1.17	5.53 ± 1.31	0.0312
AV	4.64 ± 1.22	5.05 ± 1.19	4.19 ± 1.36	0.0254
DIS	4.81 ± 1.04	4.67 ± 1.18	5.15 ± 1.367	0.2334
NC	5.12 ± 1.37	5.23 ± 1.16	4.92 ± 1.33	0.4326
INF	4.73 ± 0.97	4.58 ± 1.15	5.29 ± 1.23	0.0243

SD-Sexual Dysfunction, IMP-Impotence, PE-Premature Ejaculation, NS-Non-sensuality, AV-Avoidance, DIS-Dissatisfaction, NC-Non-communication, INF-Infrequency.

Table 3. Adjusted odds ratio for alcohol and non-alcohol groups.

	NO ALCOHOL			CONSUMED ALCOHOL		
	aOR	CI	P VALUE	aOR	CI	P VALUE
SD	-	-	-	0.909	0.366 - 2.256	0.837
IM	-	-	-	0.989	0.411 - 2.381	0.981
PE	-	-	-	1.486	0.631 - 3.500	0.365
NS	-	-	-	1.249	0.450 - 3.469	0.670
AV	-	-	-	0.513	0.213 - 1.238	0.138
DS	-	-	-	0.674	0.280 - 1.618	0.377
NC	-	-	-	0.907	0.320 - 2.571	0.854
IF	-	-	-	5.628	1.578 - 33.219	0.041

SD-Sexual Dysfunction, IMP-Impotence, PE-Premature Ejaculation, NS-Non-sensuality, AV-Avoidance, DIS-Dissatisfaction, NC-Non-communication, INF-Infrequency.

eventually progressively results in a compromise of the erectile process and manifest as erectile dysfunction as well as other forms of SD. Thus as diabetes itself could be resulting in the development of, or causation of a hypogonadal state, alcohol usage superimposes the same hypogonadal state on the alcohol consuming diabetic, it is therefore not surprising that the diabetic who consumed alcohol in this study recorded hypogonadal levels of testosterone and its bioactive components as well as higher scores for impotence (ED) even though only the levels of bioavailable testosterone reached a significant difference. Interestingly premature ejaculation and non-sensuality also recorded significantly higher le-

vels among the diabetics who consumed alcohol. This finding of difficulties in orgasmic and sexual sensation could be linked to the sedative effect of alcohol or ethanol enhanced interference in the mechanism that mediates orgasm and sensation. Ethanol could influence serotonergic and dopaminergic functions and thus compromise orgasmic feelings and sexual sensation. Similarly even though BMI and WHR did not record a significant difference when those who consumed alcohol were compared to those who did not consume alcohol, the increase in BMI and WHR recorded among alcohol consuming diabetics could also be linked to this orgasmic and sensational difficulties, as obesity in both sexes have been reported to be significantly associated with difficulties in orgasmic and sexual sensation [28] [29]. More interesting is the finding that alcohol consuming diabetics recorded higher scores for infrequency in sexual activity but lower scores for avoidance in comparison to those who did not consume alcohol. The effect of hypogonadism in decreasing male sexual libido and frequency of sexual activity is well documented and thus alcohol induced hypogonadism is less likely to be an exception. However, other studies have reported alcohol usage as improving the anxiety barrier related to sexual activity thus making diabetic alcohol users less likely to avoid sexual activity. Thus, although alcohol usage might reduce avoidance of sexual activity among users, it still has a debilitating effect on several aspects of sexual function. Clinicians who are at the forefront of treating diabetics should be encouraged to probe further into the lifestyle of their patients in other to be able to provide proper advice to such patients, as alcohol consumption could make it more difficult to resolve sexual difficulties.

6. Conclusions

Alcohol consumption among diabetic males is associated with hypogonadism and has an impact on several domains of male sexual function. Clinicians who are at the forefront of treating diabetics should be encouraged to probe further into the lifestyle of their patients in other to be able to provide proper advice to such patients, as alcohol consumption could make it more difficult to resolve sexual difficulties.

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Not Applicable.

Limitations

This study could not assess the association between the severity of alcohol consumption and sexual dysfunction because of the study design.

Declarations

1) Competing Interests:

The authors declare that they have no competing interests.

2) Authors' Contributions:

HA, WKBAO, NA and CKGS developed the concept and designed the study. HA, NA, WKBAO, PPMD, ATL, PPMD, EBAP and ATB administered the questionnaire, analyzed and interpreted the data. HA, NA, WKBAO, PPMD and ATB performed all the assay procedures. HA, WKBAO, NA, PPMD, ATL, EBAP and ATB drafted the manuscript. HA, WKBAO, NA, CKGS and ATB revised the manuscript for intellectual content. All authors read and approved the final manuscript.

3) Ethics Approval and Consent for Participation:

Ethical approval was obtained from the Committee on Human Research Publication and Ethics (CHRPE) of the School of Medical Science and the Komfo Anokye Teaching Hospital (KATH), Kumasi. All participants gave an informed and signed consent to partake in this study.

4) Consent for Publication:

All participants gave an informed and signed consent for this research to be used for publication.

5) Availability of Data and Materials:

Please contact the corresponding author for data requests.

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Abbreviations

AV	Avoidance
BMI	Body Mass Index
DBP	Diastolic Blood Pressure
DIS	Dissatisfaction
ED	Erectile Dysfunction
GRISS-M	Golombok-Rust Inventory for Sexual Satisfaction-Male
IMP	Impotence
INF	Infrequency
NC	Non-communication
NO	Nitric oxide
NS	Non-sensuality
PE	Premature Ejaculation
SBP	Systolic Blood Pressure
SD	Sexual Dysfunction
WHR	Waist-to-Hip Ratio