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RESEARCH ARTICLE

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Biochemical Assessment of Selected Nutrients Among Alcohol-Dependent Males Before and After Rehabilitation at Mathari National Teaching and Referral Hospital, Kenya

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ABSTRACT

Kenya faces numerous public health challenges, including alcohol abuse. Studies show that alcohol and drug abuse can disrupt nutrition, contributing to preventable diseases and deaths. Although nutrient deficiencies in alcoholism may be managed through nutrition therapy, the role of nutrition rehabilitation in Kenya remains underexplored. This study assessed the biochemical nutritional status Albumin, Calcium, Magnesium, and Zinc, among alcohol-dependent patients before and after rehabilitation. A pre–post experimental design was used among 62 consecutively sampled patients, assessed on admission and after 90 days. Data were collected using semi-structured questionnaires, and blood samples were analyzed for nutrient biomarkers and compared with reference standards. Nutrient adequacy proportions and mean levels before and after rehabilitation were compared using Chi-square and T-tests. Mean serum calcium increased significantly (t=2.428, P=0.018), while serum albumin and zinc showed slight, non-significant increases (t=0.742, P=0.461; t=0.445, P=0.658). Serum magnesium declined slightly (t=0.912, P=0.36). A significant increase in the number of patients with adequate nutrient levels was observed for albumin ($\chi 2$=7.3518, P=0.0067), magnesium ($\chi 2$=91.782, P=0.001), and zinc ($\chi 2$=8.1986, P=0.0042). Post-rehabilitation adequacy improved notably: albumin from 32.4% to 56.8%, zinc from 21.6% to 45.9%, and magnesium from 13.5% to 100%. Rehabilitation was associated with improved nutrient levels and biochemical adequacy among patients, highlighting its role in recovery. Based on these findings, comprehensive nutrition care should be integrated into alcohol rehabilitation programs. The government and program managers should consider developing and implementing a national alcohol nutrition rehabilitation policy to support recovery outcomes.

Keywords: Alcohol dependence, Biochemical Nutrition status, Nutrients, Rehabilitation

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INTRODUCTION

Alcohol and drug abuse is a global public health concern, United Nations Office on Drugs and Crime (Peacock, 2018) estimated 275 million people aged between 15-64 to have used drugs. WH0, 2018 noted the prevalence of drug use and disorders to have increased significantly in the period 2010-2016, a trend that is reflected in Kenya as well (Mbuthia et al., 2020). The abuse of alcohol and drugs is among the most crucial challenges facing Kenya as a country and is fast assuming alarming proportions, especially among the younger generation (Were, 2021). Extensive research conducted over the years, has consistently highlighted the several health risks connected with alcohol consumption (MacKillop et al., 2022; Shield et al., 2014).

The association between alcohol consumption and adverse health consequences such as cardiovascular diseases, liver cirrhosis, cancers, and high cholesterol is well documented (Rehm et al., 2017; Teissedre et al., 2018). Recent research revealed a rise in global incidence of alcohol-associated liver diseases, mainly cirrhosis and liver cancer, as well as alcohol use disorders, over recent decades (Danpanichkul, Suparan et al. 2024). Alcohol affects the body's relationship with nutrition in various ways; it influences the cells of the midbrain that regulate sensations of appetite and suppress desire for food while encouraging alcohol intake (Brutman et al., 2020). Furthermore, both acute and chronic alcohol consumption interfere with the nutritional process by affecting digestion, storage, utilization, and excretion of nutrients, resulting in primary malnutrition and secondary malnutrition (Kimball and Lang, 2018).
Poor biochemical nutrition status has been evident among alcohol dependent persons, this is due to alcohol displacing regular food intake, leading to nutrient deficiencies particularly proteins, vitamins, and minerals. Furthermore, alcohol metabolism disrupts nutrient absorption and utilization (Watson et al., 2013; Falode, 2024). Alcoholics tend to have clinical and/or laboratory signs of deficiencies in certain micro-nutrients, and the intensity of these deficiencies correlates with the quantity of alcohol ingested (Berger, 2019). In essence, there exists a corresponding decrease in vitamin intake and decrease in secretion of digestive enzymes from the pancreas, leading to a reduction in absorption of fat and fat-soluble vitamins which are often absorbed in conjunction with fats (Tyczyńska et al., 2024).

These changes in intestinal digestion and absorption appear to reverse once the patient ceases drinking alcohol and starts to follow a normal diet, suggesting that nutritional replacement may be of special benefit (Thomes et al., 2021). Improving nutrition services during abuse of alcohol and drugs treatment, has been linked with rapid and successful process when paired with other traditional therapies (Atkinson, 2009). This study determined the nutritional biochemical status of selected nutritents among rehabilitated alcohol dependent patients, nutritional biochemical status is a thorough e valuation that takes into account several factors to assess a person's overall nutritional well-being and identify potential imbalances hence can be a true reflection of an individual's nutritional health (Nicoll et al., 2022, Ross, 2012).

Since the early 1950s, numerous studies have focused on investigating the nutritional status of heavy alcohol consumers, but few have been carried out and documented on the same in Africa, Kenya included. Despite the fact that the Kenyan government has been concentrating on and investing a lot of resources in abuse of alcohol and drugs, nutrition rehabilitation on drug abuse remains unclear. This study therefore sought to ascertain how rehabilitation affects the biochemical nutritional status of recovering alcohol - dependent males at Mathari Hospital, the only referral drug abuse rehabilitation center in Nairobi County. This is because alcohol has been identified as the most abused substance in Kenya (Mbuthia et al., 2020), Nairobi being the most affected in comparison to other regions in Kenya, particularly in low middle - income settlements (Kamenderi et al., 2019). Thus, this paper provides a clear understanding on the result of proper nutrition during alcohol rehabilitation, a fundamental for development of policies and standards aimed at enhancing nutrition services in Kenya during alcohol and drug abuse rehabilitation.

METHODOLOGY

Study area

This study was conducted at Mathari National Teaching and Referral Hospital in Nairobi. Nairobi is the capital and largest city of Kenya which forms the Nairobi County. It is located 1°17′S 36°49′E, at 1,795 meters (5,889 ft) above sea level and occupies 696 km2 (270 sq mi) in the south central of Kenya.

Study design

This research adopted a pre-experimental (pre-post) study design. According to (Kempen, 2012), pre - experimental research designs has no control group and typically, the experiment is mostly out of the researcher's control. The patients were recruited at the admission point and the dependent variables measured before the implementation of the treatment. The treatment was then administered and after 90 days (just before discharge), a post test measurement of the dependent variable was examined to evaluate the effect of the treatment on the group.

Sample Size Determination

A sample of 79 males was computed in accordance with Omona, 2013 formula, n = z 2 pq/ d 2
N= (1.96)2*0.16(0.84)/ (0.05)2
N=207
However, since the number of rehabilitated alcoholics in the year 2010 was 107 which is less than 10,000; then the adjusted formula was used;
nf = n/(1+(n/N)
nf= (207/(1+207/107
nf= 71 Patients
A 10% non-response was added to cater for fall outs. (Suresh and Chandrashekara 2012) thus
= 71*1.1 =78.1 ≈ 79 Patients

Sampling Procedures

Mathari National Teaching and Referral Hospital was purposively selected for being the only referral hospital within Nairobi, where research by Kamenderi and Muteti (2019) found alcohol to be widely abused substance compared to other regions in Kenya. The males were consecutively sampled for the study on admission and reassessed after 90 days in alcohol and drug rehabilitation center.

Data collection tools

An interviewer administered questionnaire was used to collect data on socio-demographic characteristics such as education level, age, marital status, religion, and occupation. The questionnaire was also used to collect information such as dietary intake and disease symptoms from the alcohol dependent patients and used to determine the relationship between socio-demographic factors and nutritional status.

Data Collection Procedures

A qualified laboratory technician collected blood specimens for both pre and post assessments of selected nutrients, because methods for trace element analysis are influenced by matrix effects and issues related to contamination. Effective measures of quality assurance was in cooperated which included use of reagent blanks, replicate analysis to assess precision, calibrators in the expected concentration range of the specimens analyzed, and the use of a control or reference solution with known or certified concentrations of the elements to assess accuracy and batch-to-batch precision.

Data analysis

Biochemical findings were compared with reference ranges reported by laboratory and the indices values were recorded and frequencies done to establish the proportion of patients who were in the normal range and those with nutrient deficiencies. Completed questionnaires were coded, and entry done in database designed in Epidata. Data was then exported to STATA version 18.0. for analysis. Paired samples t-test was utilized to establish the significant mean difference in biochemical indices of selected nutrients of patients before and after rehabilitation. Results were considered significant at $p < 0.05$.

Ethical considerations

Permission to conduct the study was sought from the School of Graduate Studies and ethical approval from the Ethics Review Committee of Maseno University [MUERC] Ref. MSU/DRPI/MUERC/00518/18, and clearance from Mathari National Teaching and Referral Hospital administration (Appendix 2) where research was conducted. All patients completed a written informed consent form to take part in the study after explaining of the research study was provided to them. The questionnaires were given out along with anthropometric measurements in a private setting.

RESULTS

The study targeted 79 rehabilitated alcohol-dependent males, of which 62 rehabilitated alcohol-dependent males participated and completed the study (response rate: 87.3%). Table 1 displays the socio-demographic characteristics of the participants. The mean age in years (SD) was 37.2 (SD 7.1). Half 31 (50%) were protestants and more than half 35 (56.5%) were married. The majority, 48 (77.4%) had attained tertiary level of education, and 44 (71%) were employed. Among the employed, 37 (84%) were earning more than Ksh 20,000. Twenty-seven (43.6%) consumed both homemade and factory-made types of alcohol. Most of the patients, 46 (74. 2%), had consumed alcohol for the last 10 years. Only 8 (12.9%) reported to have consumed alcohol for less than 5 years.

Table 1:

Socio-Demographic Characteristics of Study Participants

Characteristic	Frequency (%)
Gender	
Male	62(100)
Female	0(0)
Religion	
Protestant	31(50)
Catholic	30(48.4)
Muslim	0(0)
Hindu	0(0)
Others	1(1.6)
Total	**62(100%)**
Marital status	
Single	20(32.3)
Married	35(56.5)
Widowed	2(3.2)
Divorced	5(8.0)
Total	**62(100)**
Eduucation level	
None	0(0)
Primary	7(11..3)
Secondary	7(11.3)
Tertiary	48.(77.4)
Total	**62(100)**
Employment	
Employed	44(71)
Unemployed	17(27.4)
Other	1(1.6)
Total	**62(100)**
Income (KSh) per month (employed)	
<5,000	4 (9.1)
5,000-10,000	3 (6.8)
>20,000	37 (84.1)

Total	**44(71%)**
Type of Alcohol Consumed	
Home made	11 (17.7)
Factory made	24 (38.7)
Both	27 (43.6)
Total	**62(100%)**
Duration Drinking (years)	
<5	8 (12.9)
5-10	8 (12.9)
Over 10	46 (74.2)
Total	**62(100%)**

Change in mean levels of biochemical nutrients before and after Rehabilitation

A significant difference was noted on the changes in biochemical status before and after rehabilitation. The mean serum calcium (mg/dl) before rehab was higher compared to that after rehabilitation (t=2.428, p=0.018). Minor variations were noted in serum albumin, serum magnesium (mg/dl), and serum zinc (ug/dl), although these changes were not statistically significant. (t=0.742, p=0.461; t=0.912, p=0.36 and t=0.445, p=0.658) as indicated in Table 2.

Table 2:

Change in mean levels of selected biochemical nutrients before and after Rehabilitation

Nutients	Before	After	t-value*	P-value
Serum albumin (gm/100ml)	47.4 ± 10.4	48.4 ± 8.7	0.742	0.461
Serum calcium (mg/dl)	161.1 ± 12.4	157.7 ± 8.1	2.428	0.018*
Serum magnesium (mg/dl)	31.9 ± 5.8	31.2 ± 2.5	0.912	0.365
Serum Zinc (µg/dl)	64.2 ± 21.8	65.6 ± 18.7	0.445	0.658
Serum albumin (gm/100ml)	47.4 ± 10.4	48.4 ± 8.7	0.742	0.461
Serum calcium (mg/dl)	161.1 ± 12.4	157.7 ± 8.1	2.428	0.018*

*p<0.05

Change in Biochemical Adequacy of nutrients before and after Rehabilitation

A significant increase was observed in the number of patients with adequate albumin, magnesium and zinc as per the standards after rehabilitation as compared to before rehabilitation (albumin $\chi2$=7.3518, p=0.0067; magnesium $\chi2$=91.782, p=0.001 and zinc $\chi2$=8.1986, p=0.0042). The proportion of those with biochemical nutrient adequacy also increased significantly for albumin (32.4% to 56.8%), zinc (21.6% to 45.9%) and magnesium (13.5% to 100%) after rehabilitation as indicated in Table 3

Table 3:

Change in Biochemical Adequacy of nutrients before and after Rehabilitation

Element	Normal	Abnormal	$\chi2$-value	p-value
Serum albumin (gm/100ml)				
Before	20 (32.4%)	42 (67.6%)	7.3518	0.0067*
After	35 (56.8%)	27 (43.2%)		

Serum calcium (mg/dl)				
Before	62 (100%)	0 (0%)	-	-
After	62 (100%)	0 (0%)		
Serum magnesium (mg/dl)				
Before	8 (13.5%)	54 (86.5%)	91.782	<0.001*
After	62 (100%)	0 (0%)		
Serum Zinc (µg/dl)				
Before	13 (21.6%)	49 (78.4%)	8.1986	0.0042*
After	28 (45.9%)	34 (54.1%)		

*p<0.05

DISCUSSION

The study found the mean age of the participants to be 37.2 years which in comparison to a study by Anitha, 2020 and Donogh et al., 2019 reported a similar mean age of 40.6 and early forties respectively in their subjects. Consistent age distributions in these studies shows that middle-aged adults are most affected by alcoholism due their ability to purchase and use the substances.
The study observed a similarity on the change in the mean levels of biochemical nutrients before and after rehabilitation with other studies such as Moses Elisaf and Rigas Kalaitzidis, (2015). It provided consistent evidence on chronic alcohol intake as the cause of a variety of electrolyte imbalances, as nutrient deficiencies were noted in blood markers taken on admission among alcohol-dependent patients.

The findings from this study observed that 32.4% of patients had low serum albumin before rehabilitation, which concurs with other researches such as, one conducted in China by Zhu et al., al., (2021) who reported that alcoholics have lower serum albumin compared to non-alcoholics. The research noted a slight improvement in the mean serum albumin levels after rehabilitation which could be attributed to provision of animal protein diet in the rehabilitation center. The research additionally showed that 13.5% of the patients exhibited inadequate serum magnesium levels before rehabilitation, which was marginally lower than the 32% identified by Elisaf et al., 1995 and Pavuluri et al., 2022. This difference may be ascribed to the larger sample size utilized in their studies. Serum magnesium levels was found to positively improve significantly during discharge from the rehabilitation center since all the patients had normal levels, hence reinforcing the idea that alcoholism is the most recognized cause of magnesium imbalance. Hypomagnesemia could also occur in alcohol-dependent patients through reduced intestinal absorption or increased urinary losses (Winrich et al., 2022).Lower levels of serum zinc were observed in 21.6% of the patients, which was in accordance with 18% that was noted by Pavuluri et al., 2022 in their study.Chronic alcoholism has additionally been linked to decreased serum zinc levels, as Low plasma, erythrocyte, and hepatic zinc concentrations have long been shown to follow chronic ingestion of alcohol (Skalny et al., 2018).

The mean for serum zinc levels was noted to have improved slightly after rehabilitation which could be attributed to provision of animal protein diet in the rehabilitation center, since zinc has been recognized to be effectively absorbed from food when animal proteins are included (Sloup, 2017).

The research established that serum calcium levels of all rehabilitated alcohol dependent patients was within normal range before and after rehabilitation, a fact that aligns well with findings of other studies such as Shaker and Deftos, (2023) who alluded that serum calcium is tightly regulated via an homeostatic control involving the bone tissue which is the storage site of calcium, an indication that serum calcium do not drop to deficient levels with short term changes in dietary intake. This however, contradicts with the findings of Elisaf et al., 1995 who reported higher number of patients with lower serum calcium levels, this could be attributed to a complex interplay of factors, including African diet, sun exposure and variations within different African populations. It was also established that the mean serum magnesium and calcium levels reduced slightly after rehabilitation which may have been attributed to inadequate dietary consumption in the rehabilitation center, a factor that is known to adversely affect serum levels of both minerals (Lanham-New, 2012).

Generally, following rehabilitation, the number of patients with adequate serum albumin,

magnesium and zinc increased significantly according to the standards, with 32.4% to 56.8%, 21.6% to 45.9% and 13.5% to 100% respectively as compared to before rehabilitation, this concurs with study conducted by Mehta, 2018 that showed that even short-term abstinence of alcohol can positively influence health, suggesting that alcohol affects intake, absorption and utilization of these nutrients in the body.

These findings indicate the necessity for longitudinal studies with a larger sample size to help provide better insight into the nutritional biochemical status of nutrients among alcohol dependent patients in rehabilitation centers in Kenya.

Evidence indicates that a healthy diet rich in vitamins and minerals is essential during alcohol rehabilitation to address nutritional deficiencies in patient recovering from alcoholism (Ross, 2012).

Conclusion

The emphasis of this research was on the biochemical nutritional status of selected nutrients among rehabilitated alcohol dependent males in Mathari Hospital, the element of nutrition intervention seems to be unclear in Kenyan drug abuse rehabilitation policy. The study involved 62 males, and it was found that, aside from serum calcium, more than fifty percent of the patients had low serum levels of albumin, magnesium and zinc before rehabilitation. Serum biochemical levels of the same nutrients improved slightly after rehabilitation an indication that inadequacies might be linked to alcohol consumption. While there was a decrease in the proportion of patients with low biochemical nutrients levels after rehabilitation, it was noted that means for magnesium reduced slightly while for calcium reduced significantly during rehabilitation an indication that diet provided in the rehabilitation center has to be properly prioritized and considered.

The study also has enumerated insight that may allow appropriate intervention programs to in proper application and implementation of nutrition therapy interventions during alcohol abuse rehabilitation which stand a chance to improve overall nutrition status of recovery alcohol dependent patients.

Recommendation

1. Comprehensive nutrition care should be promoted and provided in alcohol and drug rehabilitation centers.
2. The National Alcohol and Drug Abuse Policy 2018, which is silent on nutrition services in the treatment of alcohol and drug addiction, should be reviewed to incorporate nutrition element that have been linked to successful recovery rates.

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Confit of Interest

Authors declare no conflict of interest .

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Data Availability

All data sets can be obtained from the corresponding author upon request.

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