JOURNAL OF CLINICAL CARE AND MEDICAL ADVANCEMENT

https://doi.org/10.58460/jccma.v1i1.151

Open Access

ORIGINAL ARTICLE

MJM BIOLABS

Nutrient Adequacy among Alcohol-Dependent Patients Before and During Rehabilitation at Mathari National Teaching and Referral Hospital, Kenya

Emmy Cherono Langat[1*], Agatha Christine Onyango[1], Chelimo Kiprotich[2]

Authors' Affiliation

[1] Department of Nutrition and Health, School of Public Health and Community Development, Maseno University
[2] Department of Biomedical Sciences and Technology, School of Public Health and Community Development, Maseno University

[*] Corresponding author: emmy.biegon@yahoo.com

Article History
Submitted: 17th April 2024
Accepted: 1st October 2025
Published Online: 2nd October 2025

To read this paper online, please scan the QR code below:

ABSTRACT

Chronic alcohol use disrupts nutrient intake, absorption and utilization, often resulting in nutritional deficiencies. This should be addressed during rehabilitation. This study assessed the changes in dietary adequacy of selected nutrients before and during rehabilitation. A pre-experimental design (Pre - Test and Post - Test studies) was employed on 62 male respondents consecutively sampled. Interviewer administered semi-structured questionnaire and a food frequency questionnaire were used to collect information. The probability approach was used to estimate the proportion of inadequate intakes based on estimated average requirements (EAR). The mean nutrient values before and after rehabilitation were compared using the chi-square and t-test, and the results were considered significant at the 95% confidence level. The mean difference between the dietary intake before and after rehabilitation indicates that carbohydrates, proteins, Vitamin C, folate, calcium, magnesium and zinc decreased significantly during rehabilitation. The mean for Vitamin A increased significantly ($P<0.001$, $t=4.467$) while thiamine decreased but not considerably ($P=0.554$, $t=0.598$). When compared to EAR, the mean intake of all the selected nutrients were adequate, with the exception of vitamin A. The probability of inadequate nutrient intake (PINI) was high for the micronutrient's calcium, vitamin A, vitamin B1, magnesium, folate, and zinc. When compared to the EAR, the mean intake of all the nutrients were adequate except for vitamin A during the initial encounter. During the second encounter the PINI was the highest in vitamin C, folate, calcium and magnesium, all of which were 100% inadequate, in addition these nutrients were significantly below the EAR. The findings of this study revealed that those suffering from alcohol dependency experience varying degree of nutritional deficiencies, emphasizing the critical role of nutritional support during their recovery in rehabilitation centers.

Keywords: Alcohol dependence, Diet, Nutrition, Rehabilitation, Nutrients

How to Cite this Paper: Langat, E. C., Onyango, A. C., & Kiprotich, C. (2025). Nutrient adequacy among alcohol-dependent patients before and during rehabilitation at Mathari National Teaching and Referral Hospital, Kenya. Journal of Clinical Care and Medical Advancement, 1(1). https://doi.org/10.58460/jccma.v1i1.151

INTRODUCTION

Alcohol and drug abuse is a problem that has raised concern all over the world (Merz, 2018). Its consumption levels have continued to increase globally (Rehm et al., 2021). There is extensive documentation on the relationship between alcohol consumption and the negative health outcomes, including morbidity and mortality (Seitz & John, 2023) (Willmore et al., 2017). Chronic excessive alcohol consumption is well recognized for its effect on an individual's nutritional status, its association with nutrient deficiencies and malnutrition (Halsted & Medici, 2013). Alcoholics tend to have a poor diet because their normal eating behavior are disrupted. This can result in primary malnutrition, which is caused by a reduction in dietary intake, as well as secondary malnutrition, which is occurs due to impairment in the digestion, absorption, metabolism, and utilization of some nutrients (Rajendram, 2023).

(Migdanis et al., 2023)) and Mahboub et al. (2021) reported the dietary intake of drug addicts to be below the recommended intake for the majority of critical micronutrients like thiamine, riboflavin, pyridoxine, folate, vitamin D, vitamin C, magnesium, iron, calcium, zinc, copper, and selenium, resulting in overall malnutrition which can contribute to liver diseases and other serious alcohol-related disorders, demonstrating the intricate connection between nutrition and alcohol metabolism (Tadokoro et al., 2023).

Several illnesses and conditions that are classified as complications of alcohol dependency have been demonstrated to correlate with deficiencies in nutrients (Estruch et al., 2005), and there has been hope that these troublesome symptoms associated with relapse might be amenable to nutrition therapy as several factors have operated together to encourage this line of investigation, which include similarity of nutrition deficiency and relapse-related symptoms of recovery, finding that food eaten can appreciable alter mood on rapid and long-term basis (Halsted & Medici, 2013) (Atkinson, (2009).This highlights the necessity of prioritizing and focusing on optimal dietary intake in Kenyan alcohol and drug rehabilitation centers, where limited financial resources allocation for nutrition programs have been observed, hence further complicating efforts to address malnutrition in rehabilitation settings (Mumin Wellnes Solutions-Kenya,Nairobi,Kenya et al., 2024). It has been observed that combining nutritional therapies with regular treatments provides faster and more effective results during alcohol dependence recovery (Young, 2023). Due to limited data that relates to nutritional status of alcohol dependent patients undergoing rehabilitation process in Kenya, this study therefore was aimed at identifying changes in nutritional status of selected essential nutrients among alcoholic patients before and after undergoing rehabilitation treatment.

METHODOLOGY

Research Design

This study used pre -experimental (pre -post) research design. According to (Kempen, 2012), pre - experimental research designs has no control group and usually the researcher has little control over the experiment. 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 carried out to assess the effect of the treatment on the group.

Location of the Study

This research was conducted at the Mathari National Teaching and Referral Hospital, Alcohol and Drug Rehabilitation Centre in Nairobi Kenya. Nairobi has an estimated population of about 4,396,828 and a current growth rate of 3.93%, according to the KNBS 2020 census (Kenya, 2019).

Population of the Study

In 2010, Mathari National Teaching and Referral Hospital saw a peak in alcohol-dependent patient admissions, a total of 144 patients were admitted to the hospital's drug rehabilitation unit, consisting of 137 men and 7 women. Out of these, 100 men and all the women were abusers of alcohol. The study utilized a study population of 107 individuals, which is the total number of alcoholics admitted in the year 2010, the year with the highest admissions.

Sampling Framework

All adult alcohol dependent patients admitted less than seven days before the start of the study were recruited as they were still in the detoxification process and not much in terms of nutrition status had taken place, however some with active psychotic symptoms including hallucinations, delusions, confused thinking, and inappropriate behavior were excluded.

This study used a pre-experimental design, specifically pre - post, where little control is exerted by the researcher, thus no control group is used (Kempen, 2020). Participants were recruited at admission and the dependent variables measured. Treatment was then given, and a post - test measurement of the dependent variable was

carried out to assess the effect of the treatment on the group prior to their discharge after 90 days.

A sample size of 79 patients was calculated using the Mugenda and Mugenda formula (Mulati et al., 2023) and then increased by 10% to account for fallouts (Chow et al., 2017). Due to fallouts, 62 respondents participated in the study. Mathari National Teaching and Referral Hospital was purposively selected for being the only National Referral Hospital within Nairobi where research (Kamenderi & Muteti, 2019); (Michuki, 2012). Due to it being the sole public referral drug rehabilitation center in Nairobi, the Mathari National Teaching and Referral Hospital made rehabilitation services affordable to many residents.

The patients who participated in the study were consecutively selected. These patients were identified from the drug unit admission records and interviewed based on the Centre's program, the patients' availability at the time of the interview and as well as the rate of admissions per day.

Data Collection Tools and Procedures

An interviewer administered questionnaire was used to collect data on socio-demographic characteristics such as education level, age, marital status, religion, and occupation. Food Frequency Questionnaire was used to collect and assess the frequency with which food items are consumed during a period of one month, the questionnaire consisted of a list of foods and an associated set of frequency of use response categories.

Data Management and Analysis

Completed questionnaires were coded and entry done in database designed in Epidata. Data was then exported to STATA version 22.0 for analysis. Data from the food frequency questionnaires were entered into a nutrient calculator, a computer - based calculator locally developed using Microsoft Access program (Recha, 2018), to calculate approximate nutrient intake levels of the key selected nutrients: Carbohydrates, Protein, thiamine, Folate, Vitamin A, C, Magnesium, Calcium, and Zinc in each patient. The quantities were then compared with the Estimated Average Requirement (EAR) for each nutrient (Walsh et al., 2022) to determine nutrient adequacy or inadequacy among the patients. The nutrient adequacy ratio was calculated by dividing each nutrient consumed by the EAR of same food and multiplying by 100.The proportion of inadequate intakes was then estimated using a probability approach.
Nutrient intakes were grouped into six categories based on Individual's nutrient intake as a percentage of the estimated average requirement (EAR), (Example: carbohydrate intake of an individual was 50g. The probability was calculated as 50g /EAR for CHO (100) *100, 50% was <54 and the probability inadequacy was 1 or 100%). One sample t-test was used to compare the nutrient intake and Estimated Average Requirements, and Paired samples t-test to establish if there is a significant mean difference in dietary intake 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 Maseno University Ethics Review Committee [MUERC] Ref. MSU/DRPI/MUERC/00518/18, and clearance from Mathari National Teaching and Referral Hospital administration where research was conducted. All patients filled out a written informed consent for participating in the study after explaining to them what the research study was all about. The questionnaires were administered together with anthropometric measurements in privacy.

RESULTS

Socio-demographic Characteristics of Patients

Sixty-two patients completed the study. The response rate was 87.3%. All the 62 (100%) patients were males. The mean age in years (SD) was 37.2 (SD 7.1).

The mean of the selected Nutrients

The mean of the selected nutrients among the rehabilitated alcohol dependent patients for before and after rehabilitation is presented in Table 1 where the mean of nutrients; Carbohydrates, Proteins, Vitamin A and thiamine were above EAR for both before and after rehabilitation. Vitamin C, Folate, Magnesium and Zinc had higher mean than EAR before rehabilitation and lower mean than EAR after rehabilitation. Calcium mean was lower than EAR for both before and after rehabilitation.

Table 1:

Nutrient Adequacy among the Alcohol Dependent Patients before and after Rehabilitation

Nutrient	EAR	Before	After
Carbohydrates(g)	100	158.4	104.6
Protein (g)	46	99.2	66.9
Vitamin A (µg)	625	666.5	912.9
Vitamin C(mg)	75	241.9	39.9
thiamine (mg)	1	1.5	1.45
Folate (µg)	320	556.0	300.7
Calcium (mg)	1000	769.5	364.4
Magnesium (mg)	350	427.9	248.6
Zinc (mg)	9.4	13.3	9.38

Nutrient Adequacy of nutrients before Rehabilitation

Before rehabilitation, the mean dietary intake of carbohydrates, proteins, Vitamin C, thiamine, folate, magnesium and zinc were significantly higher compared to Estimated Average requirement ($P<0.001$, $df = 60$; $t = 9.538$, 13.034, 9.747, 5.428, 7.805, 4.970 and 7.194 respectively while the dietary intake of calcium was significantly below ($P<0.001$; $df = 60$ calcium $t=4.970$). Vitamin A was however not significant ($t=0.753$, $P=0.456$) as shown in Table 2.

Table 2:

Dietary Adequacy of nutrients before Rehabilitation

Nutrient	Before	EAR	t-value	P-value
Carbohydrates(g)	158.4	100	9.538	<0.001
Protein (g)	99.2	46	13.034	<0.001
Vitamin A (µg)	666.5	625	0.753	0.456
Vitamin C(mg)	241.9	75	9.747	<0.001
Thiamine (mg)	1.5	1	5.428	<0.001
Folate (µg)	556.0	320	7.805	<0.001
Calcium (mg)	769.5	1000	4.970	<0.001
Magnesium (mg)	427.9	350	4.808	<0.001
Zinc (mg)	13.3	9.4	7.197	<0.001

Nutrient Adequacy of nutrients after Rehabilitation

After rehabilitation, dietary intake of carbohydrates, proteins and Vitamin A were significantly high compared to EAR ($P<0.001$; $df = 60$; $t = 7.454$, 6.504 and 5.468 respectively, while Vitamin C, folate, calcium and magnesium were significantly low compared with EAR ($P<0.001$; $df = 60$; $t = 2.730$, 1.953, 3.580, 7.70 respectively), with no difference in thiamine and zinc levels (thiamine $t=0.745$, $P=0.094$ and zinc $t=1.320$, $P=0.563$) as shown in Table 3.

Table 3:

Dietary adequacy of nutrients after Rehabilitation

Nutrient	After	EAR	t-value*	P-value
Carbohydrates(g)	104.6	100	7.454	<0.001
Protein (g)	66.9	46	6.504	<0.001
Vitamin A (µg)	912.9	625	5.468	<0.001
Vitamin C(mg)	39.9	75	2.730	<0.001
Thiamine (mg)	1.45	1	0.745	0.094
Folate (µg)	300.7	320	1.953	<0.001
Calcium (mg)	364.4	1000	3.580	<0.001
Magnesium (mg)	248.6	350	7.70	<0.001
Zinc (mg)	9.38	9.4	1.320	0.563

Difference in means of Nutrient intake before and after Rehabilitation

Dietary intake mean differences were found in several nutrients after rehabilitation, showing significant reductions in carbohydrates, proteins, Vitamin C, folate, calcium, magnesium, and zinc ($P<0.001$; $t=7.787$, 7.603, 11.797 and 7.234 respectively, while Vitamin A increased significantly ($P<0.001$, $t=4.467$) and thiamine reduction was not significant ($P=0.554$, $t=0.598$) as presented in Table 4.

Table 4:

Difference in means of dietary intake of nutrients before and after Rehabilitation

Nutrient	Before	After	t-value	P-value
Carbohydrates(g)	158.4	104.6	7.787	<0.001
Protein (g)	99.2	66.9	7.603	<0.001
Vitamin A (µg)	666.5	912.9	4.467	<0.001
Vitamin C(mg)	241.9	39.9	11.797	<0.001
Thiamine (mg)	1.5	1.45	0.598	0.554
Folate (µg)	556.0	300.7	8.444	<0.001
Calcium (mg)	769.5	364.4	8.736	<0.001
Magnesium (mg)	427.9	248.6	11.065	<0.001
Zinc (mg)	13.3	9.38	7.234	<0.001

Prevalence of inadequate nutrient intake before and after rehabilitation (% PINI)

The probability approach method estimated the prevalence of inadequate nutrient intakes based on the Estimated Average Requirements (EAR). High inadequate nutrient intake rates were initially observed in select micronutrients, specifically in 75% of those for calcium, 56% for vitamin A, 25% for magnesium, 19% for vitamin B1, 12% for folate, and 12% for zinc. Following rehabilitation, the nutrient intake inadequacy rate increased notably in vitamin C, folate, calcium, and magnesium, with 100% of patients experiencing inadequate intake as presented in Table 5.

Table 5:

Changes in Prevalence of Nutrient Inadequacy before and after Rehabilitation

	Before Rehabilitation				After Rehabilitation		
Nutrient	EAR	Mean (sd)	%PINI	P-value	Mean	%PINI	P-value
Carbohydrate (g)	100	158.4	6%	<0.001	104.6	0%	<0.001
Protein (g)	46	99.2	6%	<0.001	66.9	0%	<0.001
Vitamin A (µg)	625	666.5	56%	0.456	912.9	0%	<0.001
Vitamin C (mg)	75	241.9	3%	<0.001	39.9	100%	<0.001
Vitamin B1 (mg)	1.0	1.5	19%	<0.001	1.45	0%	0.094
Folate (µg)	320	556.0	12%	<0.001	300.7	100%	<0.001
Calcium (mg)	1000	769.5	75%	<0.001	364.4	100%	<0.001
Magnesium (mg)	350	427.9	25%	<0.001	248.6	100%	<0.001
Zinc (mg)	9.4	13.3	12%	<0.001	9.38	0%	0.563

DISCUSSION

Maintaining proper nutrition throughout alcohol rehabilitation is a crucial aspect in restoration of nutrients (Langat et al., 2014). It supports recovery, by addressing deficiencies and mitigating the negative impact of alcohol on nutritional status (White & Sirohi, 2024), hence playing a vital role in effective alcoholic recovery outcomes.

This study analyzed the dietary intake of selected nutrients which included carbohydrates, proteins, vitamin A, C, B_1, calcium, magnesium, folate, and zinc. The results from the first encounter revealed that the mean of most of these nutrients significantly exceeded the necessary EAR except for calcium. When prevalence of inadequate nutrient intake (PINI) was used, high inadequacies were observed in calcium, vitamin A, magnesium, vitamin B_1, folate and zinc having 75%, 56%, 25%, 19%, 12% and 12% respectively, a similar trend that was noted by Halsted & Medici, (2013) and Jophlin et al., (2024) which could be attributed to inadequate dietary intake and the effects of ethanol on gastrointestinal function (Rajendram, 2023).

In the second encounter, patients showed a significant increase in vitamin A intake after 90 days of treatment with no inadequacies recorded. However, there were higher inadequacies in vitamins C, folate, calcium, and magnesium, affecting all patients. Even though these results used EAR, it aligns with previous study done by Hurt et al., (1981) indicating that middle-class adult males with alcohol dependency had adequate macronutrient (carbohydrates, proteins, and fats) intake before rehabilitation, with 7% below the recommended daily allowance. Additionally, they further revealed that higher percentages of patients with nutrient inadequacies in micronutrients such as vitamins A (38%), thiamine (34%), and ascorbic acid (28%). After patients stopped drinking in an Alcohol Dependence Unit, the intake of major nutrients, particularly carbohydrates, significantly increased, with the most notable difference in carbohydrates. This trend is consistent with another study Liangpunsakul, (2010) showing a significant reverse relationship between increasing alcohol consumption and macronutrient intakes. This could be attributed to the fact that ethanol has high caloric content with minimal nutritional value per gram compared to Carbohydrates and Proteins thus displaces them in the diet hence increase in overall intake of macronutrients (Zirnheld et al., 2022) after treatment initiation.

Nutrition services are commonly overlooked in alcohol and drug rehabilitation centers, Angeles-Agdeppa et al., (2020) reported 57.9% of the rehabilitation centers to lack Registered Nutritionist thus lacking professional nutrition guidance, while 78.9% provided uncalculated diets, especially those treating the lower economic status clients due to low funding. This was reflected in low dietary intake of nutrients among the rehabilitated alcohol dependent patients, with vitamin C, folate, calcium, and magnesium being significantly below EAR. The low levels may have been contributed by the inadequate provision of fruits, dark green leafy vegetables, and animal proteins at the center as was pointed out by the key informant, who cited inadequate funding as the primary challenge to provision of adequate nutrients. This was evident from the studies conducted by Chepkwony et al.,(2013) and Kahuthia-Gathu et al., (2013) that Kenyan rehabilitation centers place limited emphasis on optimal dietary intake despite the benefits of optimal dietary intake being associated with fast and efficient recovery (Singh, 2017).

Conclusion

This research highlights nutrient inadequacies among rehabilitated alcohol-dependent males, emphasizing the need for targeted nutritional interventions during rehabilitation. It is evident that alcohol consumption causes nutrient deficiencies, as the number of alcohol-dependent patients with Albumin, Magnesium, and Zinc deficiencies reduced significantly after rehabilitation, showing an improvement of biochemical nutrient levels during rehabilitation with no alcohol consumption.

Recommendations

These findings enumerate insight that necessitates the government and program administrators to develop comprehensive nutrition policies in alcohol and drug abuse rehabilitation programs, designed to guide and structure the delivery of nutrition services like Nutrition education, supplementation and provision of therapeutic diets.

Acknowledgements

The authors extend their gratitude to the authorities that provided the necessary approvals, clearance, and permissions for the study. Thanks to Mathari Hospital staff for their support and assistance during data collection period. Special thanks to all rehabilitated males for accepting to participate in the study.

Conflict of Interest

All authors declare no conflict of interest.

REFERENCES

Angeles-Agdeppa, I., Santos Arias, F. P., Pabustan Garingo, R. A., & Pascual Sy, J. A. J. (2020). Current Situation of Nutrition Services in Selected Drug Treatment and Rehabilitation Centers in the Philippines. International Journal of High Risk Behaviors and Addiction, 9(4). https://doi.org/10.5812/ijhrba.106918

Atkinson, M. (2009). “The best prognosis: Integrated, holistic approach to addictive disorders.” (n.d.). https://scholar.google.com/scholar

Chepkwony SJ, Chelule E, Barmao AC. An investigation into prevalence and factors contributing to relapse among alcoholics in selected rehabilitation centres in Nairobi county, Kenya. 2013. (n.d.). https://www.internationaljournalcorner.com

Chow, S.-C., Shao, J., Wang, H., & Lokhnygina, Y. (2017). Sample size calculations in clinical research. chapman and hall/CRC. https://www.taylorfrancis.com

Estruch, R., Sacanella, E., Fernández-Solà, J., & Nicolás, J. (2005). Nutritional Status in Alcoholics Supported by grants PI/020611, and G03/140 from Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Ministerio de Sanidad y Consumo, Spain. In Comprehensive Handbook of Alcohol Related Pathology (pp. 361–375). Elsevier. https://doi.org/10.1016/B978-012564370-2/50031-3

Halsted, C. H., & Medici, V. (2013). Alcohol: Effects of Consumption on Diet and Nutritional Status. In Encyclopedia of Human Nutrition (pp. 50–56). Elsevier. https://doi.org/10.1016/B978-0-12-375083-9.00007-6

Hurt, R. D., Higgins, J. A., Nelson, R. A., Morse, R. M., & Dickson, E. R. (1981). Nutritional status of a group of alcoholics before and after admission to an alcoholism treatment unit. The American Journal of Clinical Nutrition, 34(3), 386–392. https://www.sciencedirect.com

Jophlin, L., Liu, T.-Y., & McClain, C. J. (2024). Nutritional deficiencies in alcohol use disorder/alcohol-associated liver disease. Current Opinion in Gastroenterology, 40(2), 112–117. https://pubmed.ncbi.nlm

Kahuthia-Gathu, R., Okwarah, P., Gakunju, R., & Thungu, J. (2013). Trends and emerging drugs in Kenya: A case study in Mombasa and Nairobi County. Journal of Applied Biosciences, 67(0), 5308. https://doi.org/10.4314/jab.v67i0.95055

Kamenderi, M., & Muteti, J. (2019). Status of drugs and substance abuse among the general population in Kenya. African Journal of Alcohol and Drug Abuse (AJADA), 54–59. https://ajada.nacada.go.ke

Kempen, E. (2020). Experiential learning in the expanded scope of the undergraduate optometry programme at the University of the Free State [PhD Thesis]. University of the Free State. https://scielo.org.za

Kenya, R. (2019). Kenya population and housing census. https://www.knbs.or.ke

Langat, E., Wafula, S., Ettyang, G., Rotich, J., & Chelimo, J. (2014). The effect of rehabilitation on nutritional status of alcohol dependent males in Nairobi, Kenya. https://www.cabidigitallibrary.org

Liangpunsakul, S. (2010). Relationship between alcohol intake and dietary pattern: Findings from NHANES III. World Journal of Gastroenterology, 16(32), 4055. https://doi.org/10.3748/wjg.v16.i32.4055

Mahboub, N., Rizk, R., Karavetian, M., & De Vries, N. (2021). Nutritional status and eating habits of people who use drugs and/or are undergoing treatment for recovery: A narrative review. Nutrition Reviews, 79(6), 627–635. https://pubmed.ncbi.nlm.nih.gov

Merz, F. (2018). United Nations Development Programme: Journey to Extremism in Africa. New York 2017. SIRIUS – Zeitschrift Für Strategische Analysen, 2(2), 202–203. https://doi.org/10.1515/sirius-2018-2020

Michuki, G. (2012). Rapid Situation Assessment of the Status of Drug and Substance Abuse in Kenya. http://erepository.uonbi.ac.ke

Migdanis, A., Migdanis, I., Papadopoulou, S. K., Hadjivasiliou, L., Trifonova, N., Villioti, M., Giaginis, C., Kosti, R. I., Androutsos, O., & MIGDANIS, A. (2023). Assessment of dietary intake and nutritional status of former opioid users undergoing detoxification process. Cureus, 15(12). https://www.cureus.com

Mulati, N. E., Ngure, K., & Karanja, S. (2023). Predictors of treatment failure among HIV positive clients in Webuye Sub-county, Bungoma County, in Kenya. Journal of Agriculture, Science and Technology, 22(1), 16–25. https://ojs.jkuat.ac.ke

Mumin Wellnes Solutions-Kenya,Nairobi,Kenya, Mumina, L. M., Otieno, J., & ANERC consults, Kisumu, Kenya. (2024, September 12). Enhancing Multisectoral Efforts to Combat Malnutrition in Kenya; A One Health Approach. ONE HEALTH (FOOD, ANIMALS, PLANTS AND HUMANS). 4th International Nutrition and Dietetics Scientific Conference. https://doi.org/10.57039/JND-Conf-Abt-2024-MSMDC-23

Rajendram, R. (2023). Alcohol: Effects of consumption on diet and nutritional status. In Encyclopedia of Human Nutrition (pp. 266–275). Elsevier. https://doi.org/10.1016/B978-0-12-821848-8.00132-3

Recha, C. W. (2018). Local and regional variations in conditions for agriculture and food security in Kenya. AgriFoSe2030 Report, 7. https://pub.epsilon.slu.se

Rehm, J., Manthey, J., & Shield, K. D. (2021). Global Health Risk Factors: Alcohol Consumption. In I. Kickbusch, D. Ganten, & M. Moeti (Eds.), Handbook of Global Health (pp. 679–717). Springer International Publishing. https://doi.org/10.1007/978-3-030-45009-0_37

Seitz, H. K., & John, U. (2023). Gesundheitsrisiko Alkohol – neue Empfehlungen zum Umgang mit Alkohol. Die Innere Medizin, 64(12), 1224–1229. https://doi.org/10.1007/s00108-023-01574-2

Singh, K. (2017). Impact of nutrition on alcoholic liver disease: A brief review. *Indian Journal of Health and Wellbeing*, *8*(5), 391. https://pmc.ncbi.nlm.nih.gov

Tadokoro, T., Morishita, A., Himoto, T., & Masaki, T. (2023). Nutritional Support for Alcoholic Liver Disease. *Nutrients*, *15*(6), 1360. https://doi.org/10.3390/nu15061360

Toffolo, M. Marliére, C. A., & Nemer, A. (2013). Adequacy of the food offered to alcoholics in treatment and its nutritional impact. Nutr. Clinín. Diet. Hosp, 50-55. (n.d.). https://pubmed.ncbi.nlm.nih.gov

Walsh, N. M., Walton, J., Kearney, J. M., McNulty, B. A., Flynn, A., & Kehoe, L. (2022). Micronutrient intakes in a nationally representative sample of teenagers (13–18 years) in Ireland: Prevalence of inadequate intakes and risk of excess. *Proceedings of the Nutrition Society*, *81*(OCE4), E126. https://www.cambridge.org

White, B., & Sirohi, S. (2024). A Complex Interplay between Nutrition and Alcohol use Disorder:Implications for Breaking the Vicious Cycle. *Current Pharmaceutical Design*, *30*(23), 1822–1837. https://doi.org/10.2174/0113816128292367240510111746

Willmore, J., Marko, T.-L., Taing, D., & S ampasa-Kanyinga, H. (2017). The burden of alcohol-related morbidity and mortality in Ottawa, Canada. *PLoS One*, *12*(9), e0185457. https://pubmed.ncbi.nlm.nih.gov

Young, A. L. (2023). *Understanding the Role of Nutrition in Attitudes, Behaviors, and Choices of Individuals With Substance Use Disorders (SUD) in Recovery to Promote Remission* [PhD Thesis, Saybrook University]. https://search.proquest.com/openview/05b77655d38d5a48a632ae242d55f0a3/1?pq-origsite=gscholar&cbl=18750&diss=y

Zirnheld, K., Warner, J., Huirong, H., Floyd, A., Kong, M., McClain, C., & Kirpich, I. (2022). Alcohol Consumption Pattern and Nutritional Intake: Analysis of the 2017-2018 National Health and Nutrition Examination Survey. *The FASEB Journal*, *36*(S1). https://doi.org/10.1096/fasebj.2022.36.s1.r3846