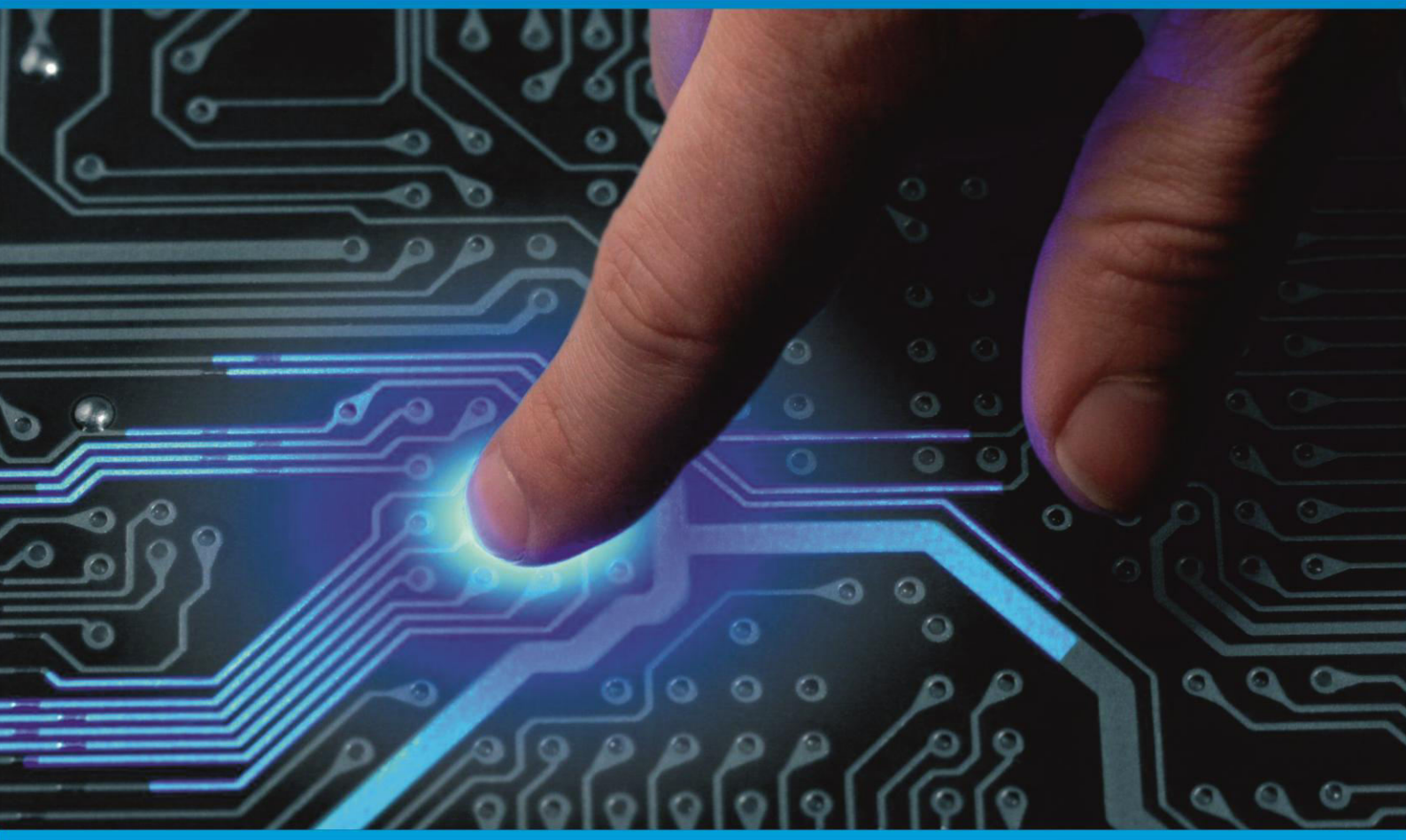
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 5, May 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 5, May 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0905056 |

A Novel Study and Analysis on Student Alcohol Consumption

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ABSTRACT: In the modern era, Alcohol consumption among the teens have become a major public health concern. Along the course of time, use of alcohol has increased among teens on a large scale and this has led to various health threats associated with excessive and prolonged consumption of alcohol. This study characterizes students of age groups 15years -18 years understanding the weekly alcohol consumption patterns and overall relation and for specific vulnerable groups.A sample of 189students were taken from 366 total students from a mathematics course consisting of both boys and girls from rural and urban areas were drawn.Stratified random sampling is use to draw sample from the targeted population. The population is divided into strata of age group 15 years to 18 years. Statistical analysis is then performed on the sample calculating sample mean, variance, standard error, margin of error and confidence intervals respectively.The main purpose of this investigation is to analyse the information available from the Student Alcohol Consumption dataset, and to understand the average rate of alcohol consumption in students of age groups 15years -18 years respectively and determine how this consumption can correlates with student academic performance, and physical and psychological health performance.The results are demonstrated based on our sample data, we estimate that our population mean is 2.9736162 for a 95% confidence level given, the margin of error around that estimate is 1.110474; and the 95% confidence interval is from 1.861643 – 4.082592. Thus, we can clearly observe that the population mean is in between the confidence interval which means an average of 2.973616 range of alcohol consumption rating is observed mostly for the entire population which openly conveys that the majority of the students in the mathematic course has an average consumption of 2.973616 of alcohol on weekly basis.From the above stated facts, calculations and analysis we can determine that alcohol intake on weekly basis amongst students is high considering the age group being from 15 years -18 years. Such amount of alcohol consumption at this age can result in affecting their physical and psychological health, their behaviour due to constand mood changes, academic and creativity loss. Over the course of time this addictive consumption of alcohol can result in permanant health losses.Therefore, strict actions shall be taken to limit the alcohol consumption among students.

KEYWORDS: Data collection; sampling studies; stratified random sampling ; population; probability; random allocation; strata; alcohol consumption; student alcohol consumption.

I. INTRODUCTION

Alcohol consumption among the teens have become a major public health concern. Along the course of time, use of alcohol has increased among teens on a large scale and this has led to various health threats associated with excessive and prolonged consumption of alcohol. It has also been noted over time that extreme alcohol consumption at a younger age has made individuals vulnerable to a wide range of hazards to the physical and psychological health of the individual. The psychological health impact is not only limited to the individual but also affects the family members and caretakers/Guardians of the individual.

Consumption of alcohol over a long course of time can take a serious toll on the health of an individual and can affect his/her body parts in different ways. A study has proved that Alcohol consumption interferes with the brain's communication activities, and can affect the way the brain looks and works making it harder to think clearly. These disruptions can lead tochanging behaviour and mood swings in an individual. It is also responsible for damaging the heart causing high blood pressure, heart stroke, Arrhythmias(irregular heart beat) and cardiomyopathy (Stretching and drooping of heart muscle). Excessive drinking of alcohol weakens your immune system making your body a much easier target for disease and also increases the risk of cancer in individuals. It also leads to a variety of problems of liver and pancreatic inflammation and swelling of blood vessels. Alcohol consumption is not just associated with just long-term health risks but also a short-term health risks, including motor vehicle crashes due to drink and drive, physical violence, sexual risk behaviours etc.

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Across the globe, heavy alcohol consumption among the students have been observed. Moreover, this heavy intake of alcohol consumption has had consequences for the individuals, the education institutes and even on the society. Alcohol consumption has not just affected the academic performance of the students but also their creative mind of the students. So, to check the alcohol consumption rate amongst students we will be conducting a statical research in depth on a secondary school student dataset acquired from Kaggle.com. The ultimate goal of this research will be to understand the average weekly alcohol consumption among students of age groups ranging from 15 years- 18 years for the entire targeted population.

II. LITERATURE SURVEY

1) **Sampling: Why and How of it?**
   Acharya, A.S., Prakash, A., Saxena, P. and Nigam, A., 2013. Sampling: Why and how of it. Indian Journal of Medical Specialties, 4(2), pp.330-333.
   Description: Since it is difficult to study the entire population all together, we generally take a small sample from the population. A 'sample' can be basically described as a subdivision of the population, selected as a representative of the large population. This research paper briefly talks about the different sampling techniques and methods in detail. Sampling methods are largely classified into 'Probability' and 'Non-probability' samples. Probability sampling permits the researcher to generalise the results of the sample to the target population. Probability sampling includes different types such as Simple random sampling, Systematic random sampling, Stratified random sampling, Cluster sampling, etc. Whereas Non-probability sampling includes Convenience/purposive sampling, Quota sampling, Snow ball etc. In spite of these, probability sampling is mostly preferred, as a fact that its results can be generalised. Each method of sampling has its own advantages, boundaries and restrictions.
2) **Stratified random sampling from streaming and stored data**
   Nguyen, T.D., Shih, M.H., Srivastava, D., Tirthapura, S. and Xu, B., 2020. Stratified random sampling from streaming and stored data. *Distributed and Parallel Databases*, pp.1-46.
   Description: This research paper focuses on stratified random sampling and its benefits in streaming data. Stratified random sampling (SRS) is anextensively used sampling technique for approximate query processing. Stratified random sampling is deliberatedon continuously incomingdata streams and statically accumulateddata sets. Afitted lower bound showing that any streaming algorithm for Stratified random sampling over the entire stream must havea variance that isfactor away from the optimal with the number of strata. They have presented the S-VOILA, a practical streaming algorithm for Stratified random sampling (SRS) over the entire stream that is locally variance-optimal.
3) **Pros and cons of different sampling techniques**:
   Sharma, G., 2017. Pros and cons of different sampling techniques. *International journal of applied research*, *3*(7), pp.749-752.
   Description: Itbecomes very essential to choose a satisfactory technique of sampling for particular type of datasets. In this paper the researchers have first clarify the proper theoretical meaning of sampling and further discussed about the different techniques and types of sampling which are probability and non- probability and their sub categories and explains the pros and cons of each sampling in depth. Pros are basically the primary positive aspect of an idea process or thing where as con's are the primary negative aspects of any idea or process. It is very necessary to choose the write sampling technique for a specific research work and understanding the pros and cons of each sampling method can be very beneficial for the researchers to select an ideal sampling method.
4) **Changes in undergraduate student alcohol consumption as they progress through university**.
   Bewick, B.M., Mulhern, B., Barkham, M., Trusler, K., Hill, A.J. and Stiles, W.B., 2008. Changes in undergraduate student alcohol consumption as they progress through university. BMC public health, 8(1), pp.1-8.
   Description: Consumption of unhealthy alcohol among the university students is becoming one of the major public health concerns. There was a raised level of consumption of alcohol noted among the UK student population and a consistent pattern was observed and marked in alcohol consumption as they progress through university. The ultimate goal of the current research was to describe drinking patterns of UK full-time undergraduate students as they progress through their degree course. Hence, data was collected over three years from 5895 undergraduate students. At the end of the research, it was noted that students reported consuming more units of alcohol in 1st year as compared to 2nd or 3rd year of their degree. Although overall female students reported a lesser consumption of alcohol as compared to male students. Students with higher

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alcohol drinking levels reported that alcohol had a negative influence on their studies, physical health and finances as compared to students with no alcohol consumption.

5) **Secondhand effects of student alcohol use reported by neighbours of colleges: the role of alcohol outlets.**
Wechsler, H., Lee, J.E., Hall, J., Wagenaar, A.C. and Lee, H., 2002. Secondhand effects of student alcohol use reported by neighbors of colleges: The role of alcohol outlets. *Social science & medicine*, *55*(3), pp.425-435.
Description: The researcher has examined the relationship of a college student's level of consistent drinking and the number of alcohol outlets in the vicinity, to the affected quality of neighbourhood life due to such second-hand effects. A telephone survey of adults from 4661 households in US were interviewed through a stratified list-assisted digit dialling which included questions regarding the second-hand effects of alcohol use. Results suggested that there was lower neighbourhood life due to the second-hand effects of alcohol consumption which led to acts such as vandalism, public disturbance, wreckage, noise and unhygienic environment due to vomiting and urination in the surrounding. The ultimate reason for heavy alcohol use was the number of alcohol outlets in the areas near colleges and the neighbourhood life disruption could be prevented by limiting the alcohol outlets in this area.

6) **Alcohol consumption: biochemical and personality correlates in a college student population.**
La Grange, L., Jones, T.D., Erb, L. and Reyes, E., 1995. Alcohol consumption: biochemical and personality correlates in a college student population. *Addictive behaviors*, *20*(1), pp.93-103.
Description: This research was conducted to understand that biochemical and personality have a mutual relationship or connection in a college student population. The rate of usage of alcohol among a college student population was evaluated using the Student Alcohol and Drug Use Survey (STADUS). In this the researcher collected Data on personality traits as measured by the Sensation Seeking Scale V (SSSV) and the Eysenck Personality Questionnaire (EPQ). And at the end three biochemical variables were evaluated which are monoamine oxidase (MAO) activity, dopamine beta hydroxylase (DBH) activity, and testosterone levels. The results conveyed that a significant proportion of the variability in alcohol use among males led to high Sensation Seeking Scale V (SSSV) scores, high testosterone levels, and low monoamine oxidase (MAO) activity. Similarly, the results among females showed that a significant proportion of the variability in alcohol use was accounted for by high Sensation Seeking Scale V (SSSV) scores, high dopamine beta hydroxylase (DBH) activity, and younger age.

7) **College student employment and drinking: A daily study of work stressors, alcohol expectancies, and alcohol consumption.**
Butler, A.B., Dodge, K.D. and Faurote, E.J., 2010. College student employment and drinking: a daily study of work stressors, alcohol expectancies, and alcohol consumption. *Journal of occupational health psychology*, *15*(3), p.291.
Description: In this research paper the relationships between daily work stress and alcohol consumption of employed college students were examined for a period of 14 days. It waspredicted that exposure to work stressors would increase the consumption rate of alcohol in college employed students. The results illustrated that workload wasn't related to alcohol consumption and particularly when students conveyed strong views and beliefs in the tension reducing properties of alcohol.

8) **Community college student alcohol use: Developing Context- specific evidence and Preventing Approaches.**
Wall, A.F., BaileyShea, C. and McIntosh, S., 2012. Community college student alcohol use: Developing context-specific evidence and prevention approaches. *Community College Review*, *40*(1), pp.25-45.
Description: The main goal of this study was to understand the heavy use of alcohol, the health issues and damage caused by alcohol consumption as well as some implication and methods of prevention of alcohol use in college students. The results suggested a significantly heavy alcohol consumption rate in college students. It was also noted that the effects of alcohol consumption by students differed based on their background, environment and students' attitude. The community colleges are encouraging to take efforts to improve the harm caused due to heavy alcohol consumption in limited institutional resources.

9) **College student perceptions on Campus Alcohol Policies and Consumption Patterns.**
Marshall BL, Roberts KJ, Donnelly JW, Rutledge IN. College student perceptions on campus alcohol policies and consumption patterns. Journal of Drug Education. 2011 Dec;41(4):345-58.
Description: This research paper is focused to examine the students' knowledge about the campus alcohol policies and their attitude towards these alcohol prohibition policies in campus. These environmental strategies and campus alcohol policies are enforced in universities and colleges to reduce the alcohol consumption in student's population. The researcher also wanted to understand the response of the students on these policies and alcohol social norms. It was concluded that those students supported these alcohol policies had less

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consumption of alcohol as compared to the alcohol consumed by students who opposed the policies and who had no opinion on these policies.

10) Alcohol consumption in tertiary education students.

Reavley, N.J., Jorm, A.F., McCann, T.V. and Lubman, D.I., 2011. Alcohol consumption in tertiary education students. *BMC public health*, *11*(1), pp.1-9.

Description: Excessive alcohol consumption among adolescents and young teens have been an issue of significant public concern. The main aim of the current research study was to survey the young students and staff members within a tertiary education institution to scrutinize patterns of alcohol use, alcohol-related health problems, knowledge about the National Health and Medical Research Council (NHMRC) guidelines for alcohol consumption and intentions to seek help for alcohol related problems. The results suggested that the majority of students and staff had accurate understanding of the current NHMRC guidelines for alcohol consumption. Psychological concernswere associated with patterns of risky drinking in students.

Theory:

Sampling:

In the view of the facts, it has been observed that studying the entire population all together is quite challenging, so we generally take a small sample from the population. A 'sample' can be basically described as a subdivision of the population, selected as a representative of the large population. This Sampling is known as a method /technique of selecting an individual or a subdivision of a population to formulate a statistical inference from them and to estimate the uniqueness of the whole population. Sampling is basically done when the population size is too large to conduct research and provide actionable insights. Many researchers use the different sampling methods available so they don't need to perform research on the entire population as sometime it is impossible or extremely costly and time consuming to conduct research on the entire population. Sampling methods are commonly used as they are time-efficient and cost-effective methods as well and the researcher can examine the samples and apply the results to the entire population.

A sample is basically termed as a small set of data that a researcher selects from a larger set of population by using a pre-defined sampling selection method. They are also known as sample points, sampling units, or observations. An efficient method of conducting a research is by creating a sample of the population.

Types of sampling methods:

There are two types of Sampling methods insampling research market

1) Probability sampling: Probability sampling is a sampling technique where the researchers set a criterionand selects a sample of the population randomly. In this case of sampling all the members of the population have equal chance of getting selected. In this type of sampling there is no bias whatever is the type of sample. Every element or individual of the population can subsequently be a part of the research.
2) Non-probability sampling: non- probability sampling is a sampling technique where the researcher selects the members at random from the population for the research. In non-probability sampling case the elements of the population do not have an equal chance of getting selected. Non- probability sampling is basically not a fixed or predefined selection process.
   This type of sampling is used for initiation stage research where the primary objective is to derive and obtain a hypothesis about the topic in research.

Stratified random Sampling:

Stratified random sampling is one of the types of probability sampling method. It is commonly used sampling technique that involves the partition and division of a respondent population into smaller groups known strata to draw conclusions from these sub-groups. In stratified random sampling, it should be noted that the strata or the sub-group should not overlap each other. This sampling method is used when the researchers want to understand the relation between two groups of a population.

To solve a stratified random sampling, we follow the seven-step process:

1) Estimate a population parameter.

The population mean is a mean average of a group characteristic. The group could be an item, person, thing, such as "all the people living in the India" or "all dogs in Mumbai". A characteristic is just an item of interest. The population mean is expressed using the μ symbol.

The formula to calculate the population mean is:

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$$\mu = \frac{(\sum \bar{X})}{N}$$

where:
Σ represents "the sum of."
X = all the individual items in the group.
N = the number of items in the group.

2) Estimate population variance.

Population variance (σ^2) help us understand how data points in a particular population are spread throughout. It is basically the average of the distance from each data point in the population to the mean, squared. The population variance is usually represented by σ^2 symbol.

The formula to use to calculatesample variance is:

$$S^2 = \frac{\sum(X - \bar{x})^2}{n - 1}$$

where:
S= sample variance
∑ represents "the sum of."
X = represents each value
$\bar{x}$ = sample mean.
n= the number of values in the sample.

3) Compute standard error.

The standard error is the standard deviation of the sample distribution of the population. The sample mean of a data is generally different from the actual population mean. This is represented as SE. It is used to measure the amount of accuracy by which the given population can be represented by its sample. The standard error is represented by SE.

The formula to calculate the standard error is:

$$SE = \frac{1}{N}\sqrt{\sum N_h^2} * \left(1 - \frac{n_h}{N_h}\right) * \frac{S_h^2}{n_h}$$

4) Specify a confidence level.

The confidence level Is basically the probability part of a confidence interval. The confidence level describes the chances/likelihood that a particular sampling method will produce a confidence interval which includes the true population parameter. A 95% confidence level means that 95% of the intervals contain the true population parameter which means if we use the same sampling method to select different samples the true population parameter will fall within the range defined by sample statistic ± margin error 95% of the time. Similarly,for a 99% confidence level means that 99% of the intervals contain the true population parameter.

5) Find the critical value.

A critical value is a point/line on the graph that is compared to the test statistic to determine whether to reject the null hypothesis. Basically, a critical value is a line on a graph that splits the graph into sections. A critical value is a componentused to calculatemargin of error.

Compute alpha (α): α = 1- (confidence level / 100).
Finding the critical probability: (p*) = 1- α/2.

we use a t-score when sample size is smalland a z-score when it is large (at least 30). You can use the Standard Normal Distribution Table to find the critical z-score, and the t distribution table to find the critical t- score statistic.

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6) Compute margin of error.

A margin of error expresses how many fractions of points your results will differ from the real factualpopulation value. A 95% confidence interval with a 4% margin of error means that statistic will be within 4 percentage points of the real population value 95% of the time. The range of values below and above of the sample statistic in a confidence interval is generally known as the margin of error.

The formula to calculate the margin of error is:
Margin of error = Critical value x Standard deviation of the statistic
Margin of error = Critical value x Standard error of the statistic

7) Define confidence interval.

A Confidence Interval is a range of values in which we are confident that our true value lies in. mostly statisticians use a confidence interval to express the precision and uncertainty with a particular sampling method. Thisprovidesa range of values for an unknown unspecifiedconstraint.

Formula to calculate the confidence interval is:

$$CL_{min} = x - SE * CV$$
$$CL_{max} = x + SE * CV$$

Where:
X= mean
SE = Standard error
CV= critical value.

III. PROPOSED ANALYSIS APPROACH

Dataset:

The dataset was taken from the Data Source: www.kaggle.com. "Student Alcohol Consumption" updated by UCI Machine Learning which conducted the survey among students that were enrolled in Mathematics and Portuguese courses in secondary school.The data in this study is only incorporated from "student-math.csv" Sampling only the students who took Mathematics course for the age group in the range of 15-18 years.

Question: At the end of the mathematics course in secondary school, a survey was conducted to estimate the sample of alcohol consumption rate in the secondary school students. This course had a total of 366 students both boys and girl in the range of age group 15-18 respectively. A proportionate stratified random sampling was used to select 188 students for testing from the entire population of age group ranging from 15-18 years consisting of 47 students each.
Using the sample data, estimate the mean alcohol consumption rating in the population. Find the margin of error and the confidence interval. (Assume a 95% confidence interval).

1) Population Parameter:

To compute the overall sample mean, we need to compute the sample means for each stratum.

$$\bar{x} = \sum \left(\frac{x_i}{n}\right)$$

Mean (Age-15) = $\bar{x}_{Age-15}$ = 2.489362

Mean (Age-16) = $\bar{x}_{Age-16}$ = 2.574468

Mean (Age-17) = $\bar{x}_{Age-17}$ = 3.553191

Mean (Age-18) = $\bar{x}_{Age-18}$ = 3.271452

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The overall sample mean of the strata is

Sample Mean $= \frac{(2.489362 + 2.574468 + 3.553191 + 3.271452)}{4} = 2.9721182.$

Thus, based on the data from the sample strata, we estimate that the mean alcohol consumption rate in the sample is equal to 2.9721182.

Population Mean = $(N_h/N)*x_h$

$$= \left(\frac{82}{366} * 2.489362\right) + \left(\frac{104}{366} * 2.574468\right) + \left(\frac{98}{366} * 3.553191\right) + \left(\frac{82}{366} * 3.2714452\right)$$
$$=0.5577259 + 0.7315428 + 0.9514008 + 0.7329467$$
$$= 2.9736162$$

Based on the data, we can estimate the mean math score for the population is equal to 63.9.

2) Population Variance:

We need to compute sample variance within each stratum, to compute standard error for every stratum.

$$S^2 = \frac{\sum(X - \bar{x})^2}{n - 1}$$

$s^2_{Age-15} = 1.646623$

$s^2_{Age-16} = 2.380204$

$s^2_{Age-17} = 2.991674$

$s^2_{Age-18} = 3.490287$

3) Standard Error:

The standard error measures the variability of our sample estimate of the population mean. We will use standard error to compute the margin of error and to define a confidence level.

$$SE = \frac{1}{N}\sqrt{\sum N_h^2} * \left(1 - \frac{n_h}{N_h}\right) * \frac{S_h^2}{n_h}$$

$SE_{Age-15} = 0.187175$

$SE_{Age-16} = 1.542791$

$SE_{Age-17} = 0.252295$

$SE_{Age-18} = 0.272509$

Thus, the standard error of the sampling distribution of the mean is 0.5636925

We are working on 95% confidence level.

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4) Confidence Level:

There are two tests, t-test and z-test. we use a t-score when sample size is small (<30) and a z-score when it is large (=>30). You can use the Standard Normal Distribution Table to find the critical z-score, and the t distribution table to find the critical t- score statistic.

Here the sample size is large i.e., greater than or equal to 30 so we use the z-test. And select the most frequently used confidence level =95%

5) Critical Value:

The critical value is a factor used to compute the margin of error. To find the critical value, we take these steps:

- Compute Alpha(α):
  α = 1 - (confidence level/100)
  α = 1 - (95/100)
  = 0.05
- Critical Probability (p^*):
  p^*= 1- (α/2)
  = 1-(0.05/2)
  = 0.975

For z-test at 95% confidence level, the critical value will be 1.97.

6) Margin of Error:

ME = (Critical Value * Standard Error)
= 1.97 * 0.5636925
= 1.110474

7) Confidence Interval:

The minimum and the maximum values of the confidence interval are:

CI_{min} = x – Standard Error * Critical Value
CI_{max} = x + Standard Error * Critical Value

CI_{min} = 2.9721182– (1.97 * 0.5636925)
= 1.861643
CI_{max}= 2.9721182+ (1.97 * 0.5636925)
= 4.082592

Summary:

Here are the results demonstrated based on our sample data, we estimate that our population mean is2.9736162for a 95% confidence level given, the margin of error around that estimate is1.110474 ; and the 95% confidence interval is from 1.861643 – 4.082592. Thus, we can clearly observe that the population mean is in between the confidence interval which means an average of 2.973616range of alcohol consumption rating is observed mostly for the entire population which openly conveys that the majority of the students in the mathematic course has an average consumption of 2.973616 bottles of alcohol on weekly basis.

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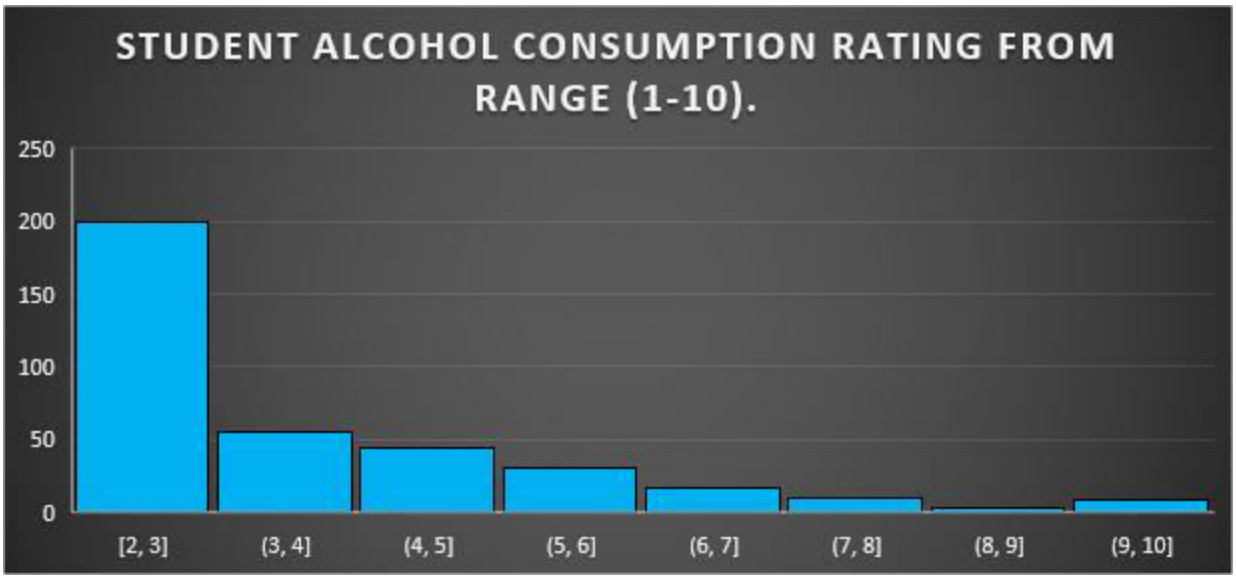

Figure 1:Graphical representation of the student alcohol consumption.

IV. FUTURE SCOPE & DISCUSSION

This stastic analysis is conducted using the stratified sampling method so that the data can be divided into age groups of 15-18 for a better understanding and easy analysis foralcohol consumption among students. This analysis was stated to understand the weekly alcohol consumption and affected age group so that necessary actions can be taken to control the after-effects of excessive alcohol consumption.

This dataset is only limited to the students from the mathematics course of the secondary school but the analysis can be futher continued for a larger age group of students to understand the alcohol consumption amongst students or individuals. It not only help in understanding alcohol consumptions of the targeted student population but also helps in focusing towards the public health growth and better social environment for students to become creative and avoid financial, academic losses.

V. CONCLUSION

To sum up all the facts stated so far an average alcohol consumption has been noted among students of age groups ranging from 15-18 years. In this particular analyis we have focused to understand the alcohol consumption in students with the dataset provided from students in the mathematic course survey. By using the technique of stratified random sampling the population was divided into stratas of different age groups and samples were drawn for the population to conduct stastic analysis on the sample. The sample mean ,variance, standard error were calculated for each strata. For confidence level of 95% , with margin of error 1.110474. After the overall calculations we accomplish that the population mean comes in between the confidence interval calculated , which clearly states that the mean alcohol consumption calculated for the sample data is also relevent to be applicable for the entire population.

From the above stated facts, calculations and analysis we can determine that alcohol intake on weekly basis amongst students is high considering the age group being from 15 years -18 years. Such amount of alcohol consumption at this age can result in affecting their physical and psychological health, their behaviour due to constand mood changes, academic and creativity loss. Over the course of time this addictive consumption of alcohol can result in permanant health losses. So to avoid all the unwanted hazzards caused due to alcohol consumption individuals bellow 21 age should be strictly restricted from the consumption of alcohol. And severe measures should be taken by the colleges and universities regarding alcohol consumption policies.

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