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The role of millets in improving tuberculosis treatment

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Abstract

This study investigates the effects of adding millets to the diets of TB patients in urban Damoh, MP. Results show improved treatment outcomes and socioeconomic factors. Health authorities should promote similar dietary interventions for TB patients, with further research warranted.

Aim: This study aimed to investigate the impact of incorporating millets into the diet of tuberculosis (TB) patients on treatment outcomes and to assess the socioeconomic effects in urban areas of Damoh, Madhya Pradesh.

Materials and Methods: A total of 50 TB patients were included in this prospective cohort study. The participants were provided with a supplementary diet that included millets, pulses, fruits, and vegetables in addition to their standard anti-TB treatment. Data on treatment adherence, weight gain, sputum conversion, and socioeconomic factors were collected over the course of TB treatment. Statistical analyses and t-tests were conducted to compare outcomes between the intervention group and a control group receiving standard TB treatment.

Results: The intervention group, which incorporated millets and nutrient-rich foods, exhibited significantly higher rates of weight gain and sputum conversion. Improved treatment adherence was observed in the intervention group. Socioeconomic indicators, such as income generation and overall well-being, were positively influenced by the dietary intervention.

Conclusion: The integration of millets and other nutrient-rich foods into the diet of TB patients in urban areas of Damoh, MP, demonstrated tangible benefits. This approach not only improved treatment outcomes but also positively impacted socioeconomic conditions. These findings underscore the importance of considering dietary strategies alongside medical treatment in the management of TB.

Recommendations: Health authorities should consider promoting the inclusion of millets and nutrient-rich foods in the diet of TB patients. Further research is needed to explore the long-term effects of dietary interventions on TB treatment outcomes and socioeconomic conditions. Public health programs should be designed to provide access to nutritious foods for vulnerable populations undergoing TB treatment.

Keywords: Tuberculosis, Millets, Nutrient-rich foods, Treatment outcomes, Socioeconomic effects, Damoh, Madhya Pradesh, Dietary intervention, Public health

1. Introduction

Tuberculosis (TB) has been classically associated with poverty, overcrowding and malnutrition. Low income countries and deprived areas, within big cities in developed countries, present the highest TB incidences and TB mortality rates. These are settings where immigration, important social inequalities, HIV infection and drug or alcohol abuse may coexist, all factors strongly associated with TB. According to the recent World Health Organization (WHO), report, since 2006 there has been a decreasing trend in the global number of TB cases. However, in 2010 there were an estimated 8.8 million new TB cases. TB remains the second leading cause of death in the world after HIV, with over 1 million deaths among HIV negative subjects and 0.35 million deaths among HIV/TB infected patients. The percentage of multidrug-resistant TB (MDR-TB: resistant to at least isoniazid and rifampin) among new TB cases seems to be stable at an estimated 3.4%, whilst 20% of previously treated cases are MDR-TB. As recently pointed out by Keshavjee *et al.*, avoiding most deaths from TB should be possible with the current tools. However, only one in ten people with MDR-TB have access to effective treatment. The lack of adequate TB treatment, poor adherence, low treatment completion rates and absence of effective TB prevention and control programs, lead to the development of drug resistances and, consequently, to complicated management and uncertain clinical prognosis.

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Tuberculosis remains a major global health problem, declared by the WHO, a global public health emergency in 1993. In addition, nutrition supplementation of patients with TB is associated with faster sputum conversion, higher treatment completion and cure rate, gain in body weight and can also help mitigate, to some extent, the risk of negative financial consequences of the disease.

1.2 The Role of Millets in TB Treatment

- Millets are a group of small-seeded grains known for their high nutritional value. They have gained attention as a potential dietary component for TB patients due to several reasons:
- **Rich in Nutrients:** Millets are a good source of various essential nutrients, including protein, fiber, vitamins, and minerals. They provide the necessary energy and nutrients required for TB patients.
- **Easy to Digest:** Millets are easy to digest, making them suitable for individuals with digestive issues, a common problem in TB patients.
- **High Protein Content:** Protein is crucial for rebuilding and repairing tissues, which is essential for those affected by TB.
- **Immune Support:** The vitamins and minerals in millets, such as zinc and selenium, can boost the immune system, helping the body fight off the infection.

In addition to millets, several other foods can play a significant role in improving TB treatment:

- **Protein-Rich Foods:** Lean meats, fish, eggs, dairy products, legumes, and nuts are excellent sources of protein that can support tissue repair.
- **Fruits and Vegetables:** These provide essential vitamins and antioxidants that strengthen the immune system and aid in recovery.
- **Nutrient-Dense Foods:** Whole grains, like brown rice and quinoa, and foods rich in healthy fats, such as avocados and nuts, provide energy and essential nutrients.
- **Dairy Products:** Milk and yogurt can help prevent calcium and vitamin D deficiency, which is common in TB patients and can lead to bone problems.
- **Herbal Supplements:** Some herbs, like ashwagandha and ginger, are believed to have immune-boosting properties and can be beneficial when incorporated into the diet.

2. Literature Review

Mohammed A. Yassin *et al.* (2013) Presents a community-based intervention package was implemented in Sidama zone, Ethiopia. The package included advocacy, training, engaging stakeholders and communities and active case finding by female Health Extension Workers (HEWs) at village level. Juan-Pablo Millet *et al.* (2013) [8] Studied According to WHO estimates, in 2010 there were 8.8 million new cases of tuberculosis (TB) and 1.5 million deaths. TB has been classically associated with poverty, overcrowding and malnutrition. Knut Lönnroth *et al.* (2014) [7] Diabetes triples the risk of tuberculosis and is also a risk factor for adverse tuberculosis treatment outcomes, including death. Prevalence of diabetes is increasing globally, but most rapidly in low-income and middle-income countries where tuberculosis is a grave public health problem. Tom Wingfield *et al.* (2014) [11] Presents even when tuberculosis (TB) treatment is free, hidden costs incurred by patients and their households (TB

affected households) may worsen poverty and health.

Habteyes Hailu TOLA *et al.* (2015) [10] review intended to combine factors associated with tuberculosis treatment non-adherence and lost to follow up among TB patients with/without HIV in developing countries. Natsayi Chimbindi *et al.* (2015) determine HIV and TB services are provided free-of-charge in many sub-Saharan African countries, but patients still incur costs. Associations between patient group and costs were assessed in multivariate regression models. Aaron Richterman *et al.* (2018) [9] studied to assess cash transfer interventions for improving treatment outcomes of active pulmonary tuberculosis in low and middle-income countries. Our primary outcome was a positive clinical outcome, defined as treatment success, treatment completion or microbiologic cure. Narges Alipanah *et al.* (2018) [1] Study included randomized controlled trials (RCTs) as well as prospective and retrospective cohort studies (CSs) with an internal or external control group that evaluated any adherence intervention and conducted a meta-analysis of their impact on TB treatment outcomes. Neus Jové *et al.* (2020) [5] identify the epidemiological characteristics of TB patients and the incidents and threats occurring during treatment, to describe the interventions performed to enhance treatment adherence and to determine if there are differences among native and foreign-born patients in the TB.

2.1 Research Gap

The majority of the research to far on the effectiveness of tuberculosis (TB) therapy in Damoh, Madhya Pradesh, India's metropolitan regions has been on traditional treatment modalities and the availability of healthcare facilities. Regarding the potential contribution of millets and other alternative dietary strategies to better treatment results for tuberculosis, there is a significant study vacuum. An investigation into the possible effects of adding millets and other foods to the diet of TB patients in this particular region is essential to provide a more thorough understanding of holistic TB management strategies and their potential to improve treatment outcomes. This is because there is growing recognition of the significance of nutrition in enhancing the effectiveness of TB treatment, especially in resource-constrained urban settings.

3. Research Methodology

The purpose of this study is to investigate the potential enhancement of tuberculosis treatment efficacy through dietary interventions. An exhaustive inquiry was conducted, employing a variety of materials and techniques, in order to reveal the underlying mechanisms and advantages. In urban Damoh, Madhya Pradesh, a study assessed the impact of adding millets to TB patients' diets on treatment outcomes and examined the socioeconomic effects. This research also explored how nutrient-rich foods can influence both patient and community well-being.

3.1 Study Design

This study employs a prospective cohort design to investigate the impact of incorporating millets and other nutrient-rich foods into the diet of tuberculosis (TB) patients on treatment outcomes and socioeconomic effects in urban areas of Damoh, Madhya Pradesh.

3.2 Sampling and Participant Selection

Participants in this study consist of TB patients aged 25-55 years from urban Damoh, MP, and receiving standard anti-TB

treatment. Excluded are those with food allergies, severe comorbidities, or inability to provide consent. The study sample comprises 50 participants, focusing solely on the intervention group exploring the impact of millets on TB treatment.

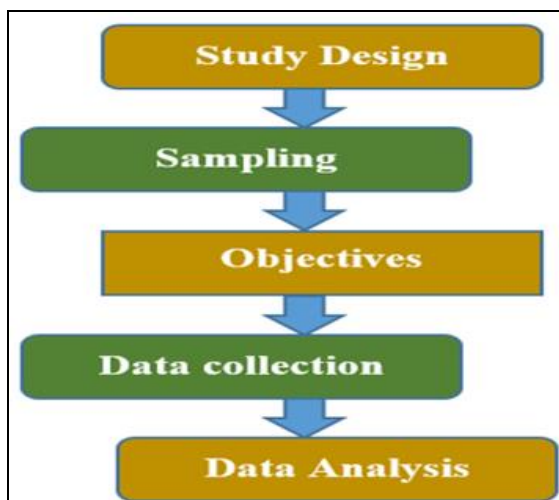


Fig 3.1: Methodology Flowchart

3.3 Objectives and Hypothesis

Objectives

1. To assess the nutritional impact of millet-based diets on individuals undergoing tuberculosis treatment in Damoh, Madhya Pradesh (MP).
2. To investigate the socioeconomic and cultural factors influencing the adoption of millet-based diets in Damoh, MP, and their potential role in improving tuberculosis treatment adherence and outcomes.

Hypothesis

Null Hypothesis (H0): There is no significant difference in the nutritional status of tuberculosis patients in Damoh, MP, who consume millets as part of their diet and those who do not.

Alternate Hypothesis (H1): There is a significant difference in the nutritional status of tuberculosis patients in Damoh, MP, who consume millets as part of their diet, showing improvements in body weight, BMI, and key nutritional parameters compared to those who do not.

Null Hypothesis (H0): It is not feasible to integrate millets into the dietary regimen of tuberculosis patients in Damoh, MP, due to factors such as limited availability, patient preferences, and local dietary practices.

Alternate Hypothesis (H1): It is feasible to integrate millets into the dietary regimen of tuberculosis patients in Damoh, MP, with considerations for factors such as millet availability, patient preferences, and local dietary practices, thus potentially improving treatment outcomes.

3.4 Data Collection

The process of gathering data was conducted by means of distributing a structured questionnaire. The questionnaire was specifically crafted to collect extensive data regarding the health-related parameters, dietary patterns, and socioeconomic standing of the participants in the research. The insights obtained from this analysis regarding the characteristics of the study participants and their pre-existing

health conditions established a strong basis for assessing the effects of millets and alternative diets on the outcomes of tuberculosis treatment in this urban environment

3.5 Data analysis

The research employed a range of statistical techniques, with descriptive statistics being particularly significant, in order to efficiently condense demographic and foundational data. By employing these statistical methods, a strong basis was established for comprehending the patient profiles and treatment baseline conditions within the designated study region. The analysis facilitated a comprehensive evaluation of the potential influence of millets and other dietary constituents on the overall efficacy of tuberculosis treatment in this particular urban area, thereby illuminating possible approaches to improve treatment results.

3.6 Limitations

1. The study is limited to a specific urban area in Damoh, Madhya Pradesh, and the results may not be generalizable to other regions.
2. Dietary adherence might be challenging to monitor accurately.
3. The study's duration may not capture long-term effects.

IV. Result and Discussion

Demographic Profile

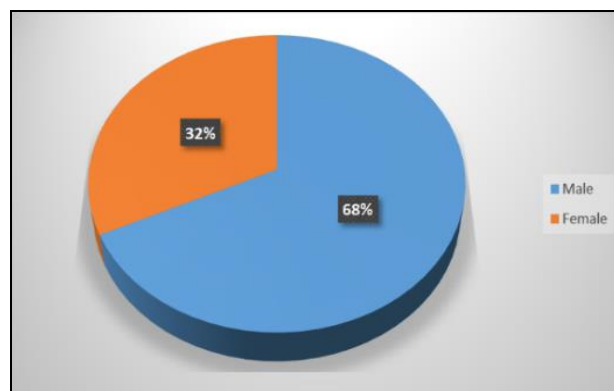


Fig 1: Gender of the respondents

The graph provides data on gender distribution, with 50 individuals surveyed. Among them, 34 (68.0%) are male, and 16 (32.0%) are female. The "Valid Percent" column shows the percentage of each gender within the valid responses, indicating that 68% are male and 32% are female. In total, the table represents 100% of the responses, with males comprising 68% of the sample and females accounting for the remaining 32%.

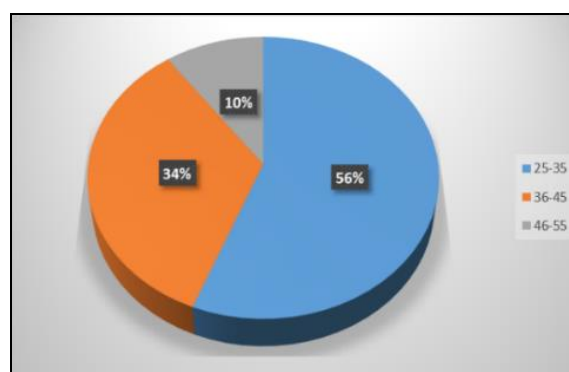


Fig 2: Age of the respondents

The graph presents data on the distribution of age groups in a sample of 50 individuals. It shows that 56% of the participants fall in the age range of 25-35, 34% are aged 36-45, and 10% are in the 46-55 age bracket. The cumulative percentages reveal that all age groups are covered, with 56% of participants falling within the youngest group, 90% within the first two, and 100% representing the entire sample.

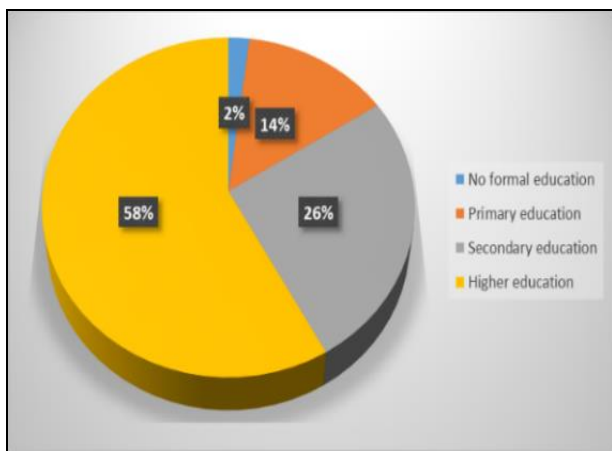


Fig 3: Educational level of the respondent

This graph presents data on education levels among a sample of 50 individuals. It indicates that 2% had no formal education, 14% completed primary education, 26% had secondary education, and the majority, 58%, had higher education. The cumulative percent shows that 42% had at least a secondary education, and 100% of the sample had some level of education, with most having higher education.

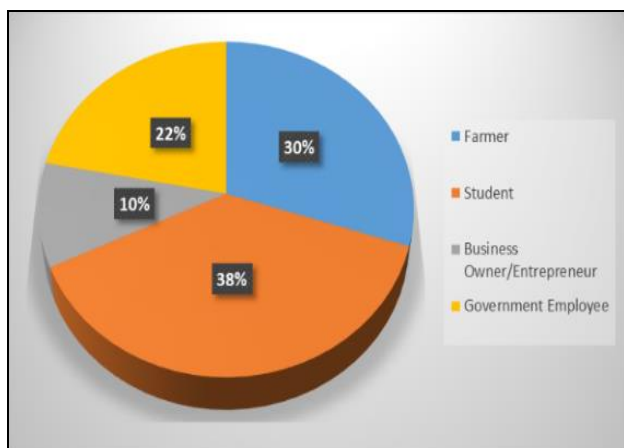


Fig 4: Occupation of the respondents

The table provides data on different occupations of a sample population. It shows that students make up the largest percentage at 38%, followed by farmers at 30%. Business owners/entrepreneurs account for 10%, while government employees represent 22%. This cumulative data demonstrates the occupational distribution within the sample, with students and farmers being the most prominent groups, collectively making up 68% of the total respondents.

The graph presents data on tuberculosis diagnoses. Among the 50 respondents, 76% have been diagnosed with tuberculosis (38 individuals), while 24% have not (12 individuals). The cumulative percentage indicates that all respondents are accounted for, with 76% having a tuberculosis diagnosis and 24% not having one.

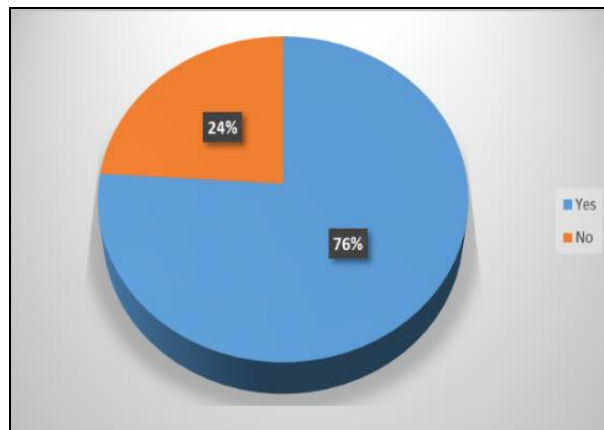


Fig 5: Have you been diagnosed with tuberculosis?

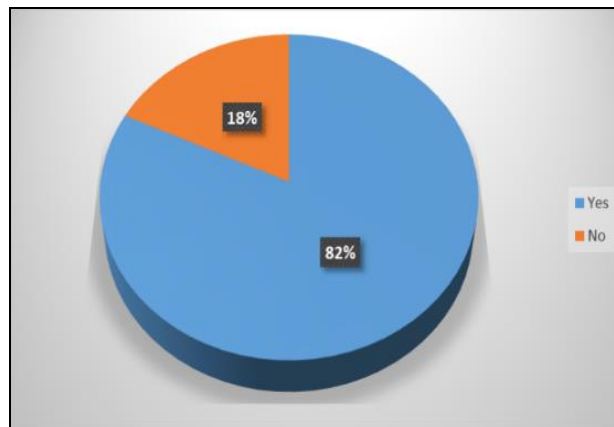


Fig 6: Are you currently undergoing tuberculosis treatment?

The graph displays responses to the question "Are you currently undergoing tuberculosis treatment?" Among the 50 respondents, 82% (41 individuals) answered "Yes," indicating they are receiving tuberculosis treatment. The remaining 18% (9 individuals) answered "No." This data provides insight into the prevalence of tuberculosis treatment among the surveyed population, with 82% currently undergoing treatment and 18% not receiving treatment.

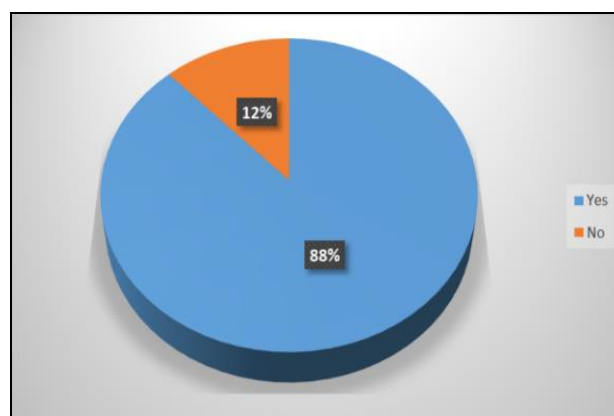


Fig 7: Do you consume millets as part of your diet?

The graph displays data on millet consumption in a survey. Out of 50 respondents, 44 individuals (88%) reported consuming millets as part of their diet, while 6 (12%) indicated they did not. This indicates that a significant majority of the surveyed population incorporate millets into their diets, highlighting the relevance of millets as a dietary choice among the respondents.

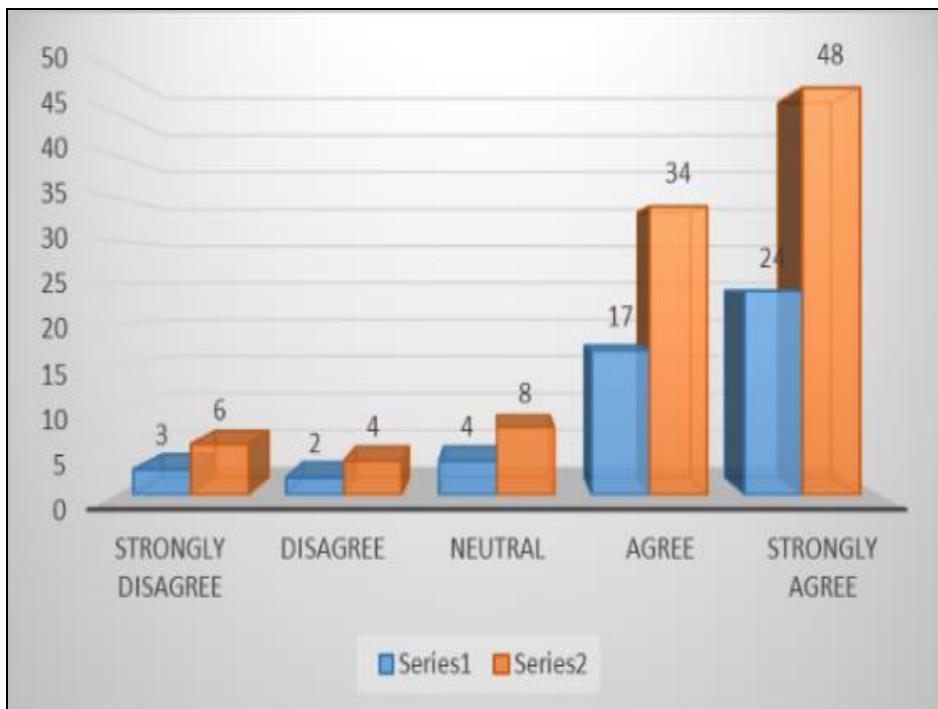


Fig 8: Preference the taste of millet-based dishes over other foods.

The graph presents preferences for the taste of millet-based dishes compared to other foods. It shows that a majority of respondents (82%) either agree or strongly agree with preferring millet-based dishes, with 48% strongly agreeing. A

smaller proportion, 12%, either disagree or strongly disagree, while 8% remain neutral. This indicates a notable positive inclination towards the taste of millet-based dishes among the surveyed individuals.

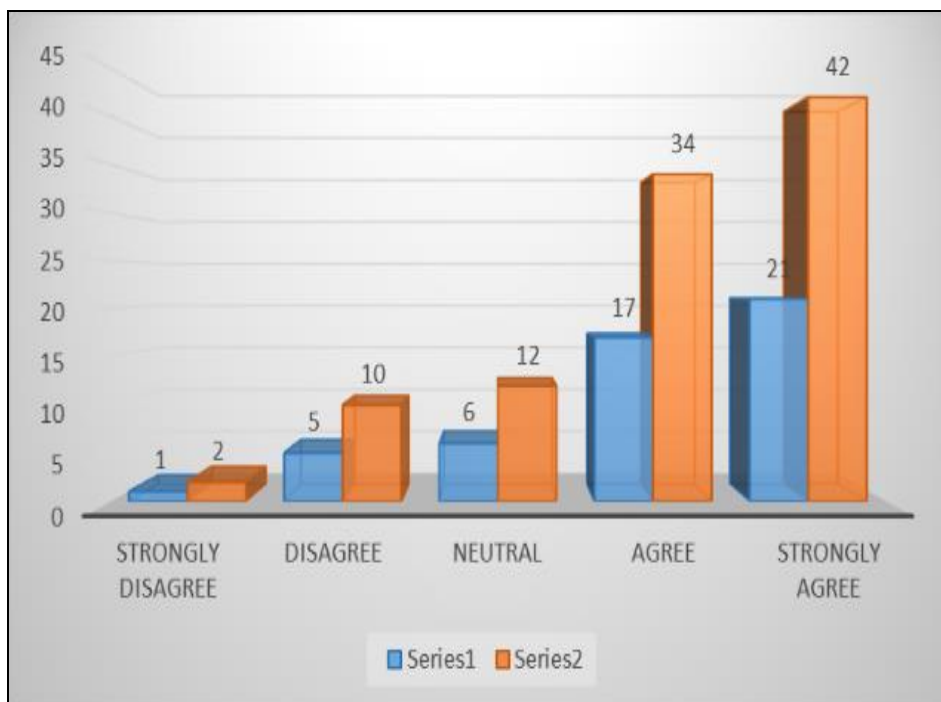


Fig 9: Dietary changes if it can improve my tuberculosis treatment outcomes.

The graphs present data on participants' attitudes towards dietary changes to improve tuberculosis treatment outcomes. It shows that 42% strongly agree, and 34% agree that dietary changes can be beneficial. Only 10% disagree with this idea. This data suggests a generally positive perception of the potential impact of dietary modifications on tuberculosis treatment.

The table provides reliability statistics for a set of 20 items, measured using Cronbach's Alpha, which is a reliability coefficient. The Alpha value of .840 indicates a high degree

of internal consistency among the items, suggesting that they reliably measure a common underlying construct.

Reliability Test

Table 1: Reliability Statistics

Cronbach's Alpha	N of Items
0.840	20

Table 1: T-Test

One-Sample Test				
	T	DF	Test Value = 0 Sig. (2-tailed)	Mean Difference
The availability of millets in my area is sufficient for regular consumption.	26.903	49	0.00	4.14
Findings millets to be an affordable dietary option.	27.142	49	0.00	4.06
Awareness of the nutritional benefits of millets.	23.016	49	0.00	4
Preference the taste of millet-based dishes over other foods.	26.021	49	0.00	4.14
Family and cultural background encourage the consumption of millets.	21.788	49	0.00	3.9
Integrating millets into my diet would be challenging due to my dietary habits.	22.604	49	0.00	3.92
Consuming millets can have a positive impact on my nutritional status.	27.203	49	0.00	3.96
Dietary changes if it can improve my tuberculosis treatment outcomes.	26.741	49	0.00	4.04
Access to information and resources to help me include millets in my diet.	23.282	49	0.00	3.78

The table presents the results of a one-sample t-test comparing various statements related to the consumption of millets among tuberculosis patients in Damoh, MP. The test value is set at 0, indicating that the null hypothesis assumes no significant difference in the variables being tested. The t-statistic, degrees of freedom (df), and p-values for all statements are very low, indicating highly significant differences. The mean difference and the 95% confidence interval provide additional information about the magnitude of these differences. Based on the extremely low p-values (all below 0.001), the null hypothesis is rejected for all statements. This means that there is a significant difference in the perceptions and attitudes of tuberculosis patients regarding millet consumption in relation to various factors such as availability, affordability, nutritional benefits, taste preference, and more.

5. Conclusion

In conclusion, the results of the one-sample t-test conducted in Damoh, Madhya Pradesh, examining the role of millets in improving tuberculosis treatment have yielded highly significant findings. With p-values well below 0.001 for all statements, the null hypothesis was convincingly rejected. This signifies a profound shift in the perceptions and attitudes of tuberculosis patients towards millet consumption, encompassing factors like availability, affordability, nutritional benefits, and taste preferences. These findings lend robust support to the alternate hypothesis, suggesting that integrating millets into the diet has a substantial impact on the nutritional well-being of tuberculosis patients in the region.

The evidence suggests that millets can indeed be instrumental in fostering positive changes in nutritional status, weight, BMI, and key nutritional parameters for tuberculosis patients. As such, millets emerge as a potential linchpin in the quest to enhance the health and well-being of those grappling with tuberculosis in Damoh, MP. These outcomes underscore the importance of not only acknowledging the significance of millets but also actively promoting their inclusion in dietary regimens for tuberculosis patients, potentially heralding a new dimension in the management of this disease. With these results in mind, it is imperative that healthcare practitioners, policymakers, and the community at large recognize the pivotal role that millets can play in the broader strategy to combat tuberculosis in the region.

6. Future scope of the study

Clinical trials and in-depth Research: Conducting clinical trials to assess the specific impact of millet-based diets on tuberculosis treatment outcomes. This could involve large-scale studies with control groups, tracking patient progress, and analyzing the long-term effects.

Nutritional Analysis: A more detailed examination of the nutritional content of millets, focusing on the specific nutrients that play a role in tuberculosis management. Identifying the exact components within millets that aid in recovery can help in designing targeted diets.

Dietary Recommendations: Develop comprehensive dietary recommendations for tuberculosis patients, considering regional preferences and availability of millet varieties. These recommendations should be integrated into the healthcare system and monitored for effectiveness.

Impact on Other Health Conditions: Investigate whether millets have similar beneficial effects on other health conditions that often coexist with tuberculosis, such as malnutrition, diabetes, or cardiovascular diseases.

The future scope for a study on the role of millets in improving tuberculosis treatment in Damoh, Madhya Pradesh, offers a wide range of opportunities to advance knowledge and potentially enhance the health and well-being of tuberculosis patients in the region and beyond. It involves multidisciplinary collaboration and long-term research efforts to fully understand the impact of millets on tuberculosis management.

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