



Nutritional Education and Prevention of Arterial Hypertension in Adolescents: A Study at Francisco Manyanga Secondary School, Tete 2025

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ABSTRACT

The study entitled “*Evaluation of Nutritional Education Interventions in the Prevention of Arterial Hypertension Among Adolescents Aged 15 to 19 at Francisco Manyanga Secondary School, in the City of Tete, in 2025*” aimed to assess the effectiveness of nutritional education interventions in preventing arterial hypertension among adolescents. The research sought to determine the extent to which educational actions contribute to the adoption of healthy eating habits and the reduction of risk factors associated with hypertension, a major chronic non-communicable disease in public health.

The study employed a descriptive and analytical quantitative design involving 80 adolescents enrolled at Francisco Manyanga Secondary School. The intervention consisted of four structured educational sessions delivered weekly over one month, covering topics such as balanced diet, reduction of salt and sugar intake, avoidance of ultra-processed foods, and the importance of regular physical activity. Sessions were conducted through interactive lectures, group discussions, and visual aids. Pre- and post-intervention questionnaires assessed nutritional knowledge, dietary habits, perceptions, and risk factors. Anthropometric measurements and blood pressure readings were also collected at baseline and after the intervention.

Results indicated a marked improvement in nutritional knowledge, with the proportion of correct responses increasing from 42.5% at baseline to 76.3% post-intervention. Reported appreciation for fruits and vegetables increased, though consumption remained concentrated in the “sometimes” category. Soft drink consumption persisted as a risk factor, with 47.5% of participants reporting intake “sometimes.” Regular meal practices showed moderate improvement. Statistical analysis using paired t-tests confirmed significant differences in knowledge scores ($p < 0.01$), while changes in reported behaviors were less consistent. No statistically significant differences were observed in blood pressure measurements.



In conclusion, nutritional education interventions were effective in improving knowledge and attitudes, initiating behavioral changes, but did not demonstrate measurable reductions in blood pressure within the short intervention period. The findings highlight the importance of continuous reinforcement, integration into school curricula, family involvement, and supportive food environments to consolidate healthy practices.

INTRODUCTION

This article seeks to evaluate the effectiveness of nutritional education interventions in preventing arterial hypertension among adolescents at Francisco Manyanga Secondary School, in Tete. In doing so, it aims to address existing gaps in Mozambican literature and provide evidence to inform public health and education policies.

Hypertension is widely recognized as one of the leading global public health problems, responsible for millions of premature deaths each year (World Health Organization, 2023). Although traditionally associated with adult populations, recent studies reveal a concerning increase in prevalence among adolescents, particularly in low- and middle-income countries. In these contexts, rapid urbanization and nutritional transition have fostered the consumption of ultra-processed foods rich in sodium, sugars, and saturated fats (Popkin et al., 2021; Silva et al., 2021).

Furthermore, excessive intake of salt, soft drinks, and fried foods, combined with insufficient consumption of fruits and vegetables, contributes to the early risk of hypertension and other non-communicable chronic diseases (Monteiro et al., 2020; Ferrari, 2024). Evidence indicates that healthy dietary patterns, such as the DASH diet, are associated with reductions in blood pressure among adolescents (Bricarello, 2018; Koziol-Kozakowska et al., 2024). These findings underscore that adolescence, defined between 15 and 19 years of age, represents a critical period for the establishment of dietary habits and health-related behaviors.

At this stage, the adoption of inadequate eating practices such as excessive consumption of salt, sugar, saturated fats, and ultra-processed foods together with low intake of fruits, legumes, and vegetables, significantly increases the risk of early development of cardiovascular diseases.

In this context, nutritional education emerges as an essential health promotion strategy, capable of fostering critical skills and encouraging conscious food choices. The school environment is particularly favorable for such interventions, as it enables the engagement of adolescents from diverse socioeconomic backgrounds and supports the consolidation of long-term practices (Freitas & Silva, 2020).

Therefore, assessing the effectiveness of structured nutritional education interventions delivered through planned sessions, interactive methods, and pre- and post-assessment tools becomes crucial to understanding their impact not only on knowledge and reported behaviors but also on measurable indicators of hypertension risk.

Problematization

The problematization of this study arises from the observation that arterial hypertension, traditionally considered a condition prevalent among adults and the elderly, has increasingly manifested among adolescents, including in school settings. This phenomenon reflects social, economic, and dietary transformations that are impacting the health of Mozambican youth and demands effective responses through nutritional education and health promotion strategies.

At the global level, hypertension is recognized by the World Health Organization (WHO, 2023) as one of the leading causes of premature death, accounting for approximately 10 million deaths annually. Although most cases occur in adults, recent studies have highlighted the early onset of hypertension and its risk factors among adolescents, particularly in low- and middle-income countries where rapid urbanization and shifts in dietary and physical activity patterns prevail (Popkin et al., 2021).



In Mozambique, a nutritional transition is underway, characterized by a decline in the consumption of traditional foods and an increase in the intake of ultra-processed products rich in sodium, sugars, and saturated fats (Ministry of Health of Mozambique [MISAU], 2022). These dietary changes, combined with sedentary lifestyles and limited nutritional knowledge, contribute to the growing risk of hypertension among young people (Souza & Lima, 2022).

Francisco Manyanga Secondary School, located in the city of Tete, is embedded within this social and nutritional context, reflecting inequalities in access to information and healthy eating practices. Consequently, it becomes a privileged setting to examine how structured nutritional education interventions delivered through planned sessions, interactive methods, and systematic evaluation can positively influence adolescents' eating behaviors and health outcomes.

Scientific literature emphasizes that dietary habits acquired during adolescence tend to persist into adulthood, directly influencing the occurrence of chronic diseases such as hypertension, diabetes, and obesity (Monteiro et al., 2020; Silva et al., 2021). In this regard, nutritional education plays a central role as a tool for transforming eating behavior, fostering the development of critical skills and autonomy in making healthier food choices.

Nevertheless, the effectiveness of such interventions depends on multiple factors, including the methodology employed, the duration and frequency of activities, and the sociocultural context of adolescents (Costa et al., 2021). Theoretically, systematic and participatory interventions conducted in school environments are expected to enhance nutritional knowledge and reduce exposure to risk factors for hypertension (Popkin et al., 2021). However, gaps remain in the literature regarding the empirical measurement of these effects in Mozambican schools, which justifies the present study.

Research conducted in different countries has demonstrated promising results from school-based nutritional education programs, showing improvements in dietary knowledge and reductions in salt and sugary beverage consumption (Monteiro et al., 2020; Freitas & Silva, 2020). Yet, within the Mozambican context, systematic studies assessing the effectiveness of such interventions in preventing chronic diseases—particularly among adolescents are still lacking.

According to MISAU (2022), the country faces a worrying increase in hypertension prevalence among young people, while public policies remain insufficiently directed toward the school-age population. The absence of local data hinders the planning of effective educational strategies and the integration of health and education sectors. This empirical gap underscores the need for an in-depth investigation into the influence of nutritional education on behavior change and hypertension prevention among students at Francisco Manyanga Secondary School.

Based on these considerations, the central research problem is delineated as follows: **What is the effectiveness of nutritional education interventions in preventing arterial hypertension among adolescents aged 15 to 19 years at Francisco Manyanga Secondary School, in the city of Tete, in 2025?**

This guiding question reflects the effort to empirically assess the impact of educational actions within the school context, linking adolescents' nutritional knowledge, dietary habits, and clinical indicators of blood pressure.

METHODOLOGY

This study adopted a descriptive and analytical design with a quantitative approach, conducted at Francisco Manyanga Secondary School, in the city of Tete, in 2025. The sample consisted of 80 adolescents aged between 15 and 19 years, selected intentionally.

Intervention Procedures

The intervention comprised four structured educational sessions, delivered weekly over one month. Each session lasted approximately 60 minutes and was facilitated by trained health educators. The content covered:



- Session 1: Fundamentals of balanced nutrition and the role of macronutrients.
- Session 2: Hypertension prevention, focusing on reducing salt and sugar intake.
- Session 3: Risks of ultra-processed foods and benefits of fruits, legumes, and vegetables.
- Session 4: Active lifestyle practices, including the importance of regular physical activity and meal regularity.

Delivery methods included interactive lectures, group discussions, visual aids (posters and slides), and participatory activities such as food-choice exercises.

Assessment Procedures

Structured questionnaires were administered before the first session (baseline) **and** after the final session (post-intervention). These instruments assessed:

- Nutritional knowledge (via the Nutritional Knowledge and Behavior Questionnaire – NKBQ).
- Dietary habits and frequency of food consumption.
- Physical activity practices.
- Perceptions of the educational messages.

Anthropometric measurements (weight, height, BMI) and blood pressure readings were collected at baseline and post-intervention using a calibrated digital sphygmomanometer, following World Health Organization (WHO, 2023) protocols.

Data Collection Instruments

- Data collection form: demographic information, anthropometric measurements, and blood pressure.
- NKBQ: validated questionnaire adapted to the Mozambican context.
- Digital sphygmomanometer: calibrated and used according to WHO guidelines.

Data Analysis

Data were analyzed using SPSS software. Descriptive statistics (means, frequencies, percentages) summarized baseline and post-intervention results. Comparative analysis was conducted using paired t-tests for continuous variables (knowledge scores, blood pressure) and McNemar's test for categorical variables (dietary habits). Statistical significance was set at $p < 0.05$, and effect sizes (Cohen's d) with 95% confidence intervals were reported to quantify the magnitude of changes.

Ethical Considerations

The study was approved by the institutional ethics committee. Informed consent was obtained from all participants and their guardians. Confidentiality and voluntary participation were ensured throughout the research process.

General Objective

To evaluate the effectiveness of structured nutritional education interventions in preventing arterial hypertension among adolescents aged 15 to 19 years at Francisco Manyanga Secondary School, in the city of Tete, in 2025.



Specific Objectives (Revised)

- To determine the prevalence of risk factors associated with arterial hypertension among the participating adolescents, based on dietary habits, physical activity, anthropometric indicators, and blood pressure measurements.
- To analyze the relationship between the nutritional knowledge acquired through the intervention and the adoption of healthier eating behaviors, distinguishing improvements in knowledge and reported practices from measurable changes in clinical indicators of hypertension risk.
- To assess the level of acceptance and perceived relevance of the educational sessions among adolescents, identifying strengths and limitations in the delivery of the intervention.
- To provide evidence to inform school-based health promotion strategies and public health policies in Mozambique.

LITERATURE REVIEW

Arterial Hypertension as an Emerging Problem Among Adolescents

For a long time, arterial hypertension was considered a condition restricted to adulthood. However, in recent decades, its increasing prevalence among adolescents has drawn the attention of the scientific community and public health authorities (World Health Organization [WHO], 2023). This phenomenon is mainly attributed to changes in dietary patterns, sedentary lifestyles, and excess body weight (Monteiro et al., 2020).

Studies conducted in African and Latin American contexts demonstrate that the high consumption of ultra-processed foods rich in sodium, fats, and sugars has significantly contributed to rising blood pressure levels among young people (Popkin et al., 2021; Silva et al., 2021). In Mozambique, the *National Strategic Plan for the Prevention of Non-Communicable Chronic Diseases (2022–2026)* highlights juvenile hypertension as a major public health concern.

Adolescents, particularly those aged 15 to 19, are in a developmental stage marked by autonomy in food choices, often influenced by media, convenience, and the availability of industrialized foods (Souza & Lima, 2022). This context reinforces the need for educational strategies that strengthen nutritional knowledge and promote preventive attitudes.

Nutritional Education: Concept, Principles, and Relevance

Nutritional education is defined by the Food and Agriculture Organization (FAO, 2013) as a set of educational strategies aimed at promoting sustainable changes in eating behavior, based on an understanding of cultural, social, and economic determinants of diet.

According to Freitas and Silva (2020), educational interventions must go beyond the mere transmission of information; they should stimulate critical reflection, individual empowerment, and community engagement. Effective nutritional education actions employ participatory methodologies, interactive approaches, and real-life contexts from students' daily experiences (Costa et al., 2021).

Within the school context, nutritional education is integrated into the concept of the health-promoting school, advocated by WHO (2023), which seeks to develop competencies for healthy choices. Several studies show that structured food education programs have the potential to improve knowledge and modify risk behaviors, such as excessive consumption of salt and soft drinks (Monteiro et al., 2020; Freitas & Silva, 2020).

Nutritional Knowledge and Its Relationship With Eating Habits

The level of nutritional knowledge is an important determinant of dietary practices. Adolescents who under-



stand the principles of a balanced diet are more likely to adopt healthier behaviors and reduce the consumption of foods with low nutritional value (Silva et al., 2021).

Nevertheless, studies indicate that knowledge alone does not always translate into behavioral change, as it is mediated by psychological, social, and environmental factors (Freitas & Silva, 2020). Thus, the role of educational intervention is precisely to connect information and action, using pedagogical resources that stimulate adolescents' interest and critical reflection (Costa et al., 2021).

In the case of Francisco Manyanga Secondary School, analyzing pre- and post-intervention knowledge will allow the identification of whether the implemented educational strategies effectively enhance nutritional literacy an essential step in preventing arterial hypertension.

Changes in Eating Habits and Consumption of Risk Foods

According to Popkin et al. (2021), nutritional transition in developing countries has led to the replacement of natural foods with ultra-processed products, increasing sodium, fat, and sugar intake. This trend is particularly evident among adolescents, who often eat outside the home and consume fast food and sugary beverages (Souza & Lima, 2022).

Changes in eating habits are one of the main indicators of success in nutritional interventions. School-based interventions that combine theoretical education with practical culinary activities such as workshops, games, and campaigns have shown positive results in reducing the consumption of industrialized foods and increasing fruit and vegetable intake (Costa et al., 2021). Therefore, analyzing changes in eating habits before and after the intervention constitutes a central axis of this study, as it directly reflects the effectiveness of educational actions in preventing hypertension risk factors.

Clinical Indicators of Blood Pressure and Hypertension Prevention

According to WHO (2023), approximately 25% of adolescents in African countries present borderline blood pressure levels, indicating a predisposition to hypertension in adulthood. Clinical assessment of blood pressure is thus an essential component for measuring the physiological effects of nutritional education interventions.

Educational interventions that promote reduced salt intake and healthier habits, even in the short term, have demonstrated improvements in mean blood pressure (Monteiro et al., 2020). Monitoring indicators before and after the intervention will therefore allow the evaluation of whether behavioral changes translate into measurable clinical benefits among Francisco Manyanga students.

Relationship Between Nutritional Knowledge and Eating Behavior

The literature shows that the simple transmission of information does not guarantee behavioral change; it is necessary to stimulate autonomy, motivation, and a sense of responsibility (Freitas & Silva, 2020). Understanding the relationship between acquired knowledge and eating practices is one of the central challenges of nutritional education.

Research by Costa et al. (2021) indicates that adolescents who participate in continuous nutritional education programs demonstrate a stronger correlation between theoretical knowledge and everyday practice, especially when interventions include practical and interactive activities. Evaluating this correlation at Francisco Manyanga Secondary School will make it possible to understand the effectiveness of pedagogical strategies and their influence on eating behavior and hypertension prevention.

DISCUSSION OF RESULTS

The findings of this study reveal a high level of acceptance and credibility regarding nutritional education messages, with elevated proportions of correct ("true") responses associated with fruit and vegetable consumption (70–87.5%), reading of educational content (70–87.5%), and engagement in physical activities



(72–90%). At the same time, eating behaviors remain transitional: meal regularity was reported as “sometimes” (50%), “rarely” (40%), and “always” (10%), while soft drink consumption appeared predominantly as “sometimes” (47.5%), followed by “rarely” (32.5%) and “always” (20%). The final evaluation of the interventions 67.5% “good,” 25% “average,” and 7.5% “poor” indicates strong acceptance and potential for continuity, but also demonstrates that the transformation of knowledge into daily routine is not yet fully consolidated.

Statistical analysis confirmed significant improvements in nutritional knowledge scores (paired t-test, $p < 0.01$; Cohen’s $d = 0.65$, 95% CI [0.42–0.88]), indicating a moderate-to-large effect size. However, changes in reported dietary behaviors (fruit and vegetable intake, soft drink consumption, meal regularity) did not reach statistical significance (McNemar’s test, $p > 0.05$). Blood pressure measurements showed no significant differences between baseline and post-intervention (mean systolic BP: 118.4 mmHg vs. 117.9 mmHg, $p = 0.62$), suggesting that the short duration of the intervention was insufficient to produce measurable physiological effects.

These results align with the literature on school-based nutritional education. Costa, Santos, and Almeida (2021) emphasize that educational interventions are most successful when integrated into curricula, practical activities, and the school environment, yet they identify a recurring challenge: converting gains in knowledge and attitudes into consistent behavioral change. The present findings high credibility of messages and positive evaluations, but consumption and meal patterns concentrated in “sometimes/rarely” mirror this gap between intention and practice. The FAO global review (2013) reinforces that isolated interventions focused solely on pedagogical content have limited impact; stronger effects emerge when aligned with school policies (canteens, fruit and vegetable provision, water availability), family participation, and programmatic continuity.

Freitas and Silva (2020) highlight that stable habits require repetition, positive reinforcement, and connection with family realities. The high levels of correct responses regarding reading and practice suggest a solid motivational base; however, the persistence of soft drink consumption and irregular meals indicates that the out-of-school context (home, community, nearby points of sale) still favors intermediate choices. In Mozambique, the National Strategic Plan for the Prevention of NCDs (MISAU, 2022) advocates precisely for intersectoral actions and healthy food environments from school canteen policies and gardens to local procurement and community communication to reduce risk factors such as sugar consumption and sedentary lifestyles.

The literature on ultra-processed foods helps interpret the role of soft drinks in this cohort. Monteiro et al. (2020), through the NOVA classification, demonstrate that high exposure to ultra-processed foods deteriorates diet quality and increases cardiometabolic risk. The “sometimes” pattern for soft drinks suggests a constant, though not daily, presence, with potential to maintain taste preferences oriented toward sweetness and convenience. This reinforces the need for substitution policies (water, fruits, natural juices without added sugar), sensory education, and simple, low-cost culinary workshops, as well as concrete behavioral goals (“30 days without soft drinks,” “one fruit per day at school”) to transform belief into repeated practice.

From an epidemiological perspective, these findings fit within the dynamics of the double burden of malnutrition described by Popkin, Corvalan, and Grummer-Strawn (2021): risks of deficiencies coexist with overweight, alongside increasing availability of ultra-processed foods. In urban and peri-urban contexts of Mozambique, including Tete and Nampula, access to fresh foods is often irregular, while soft drinks and snacks are more available and socially valued. This underscores the importance of strategies centered on the food environment and relative prices: without rebalancing availability and cost, acquired knowledge tends to clash with everyday preferences and conveniences.

Regarding adolescent hypertension, studies such as Silva, Oliveira, and Pereira (2021) and the review by Souza and Lima (2022) point to associations between dietary patterns high in sugars, irregular meals, and sedentary lifestyles with increased cardiovascular risk and elevated blood pressure. The focus of this study nutritional education for hypertension prevention is therefore both appropriate and timely. The challenge lies in transforming strong acceptance of messages into measurable routines: reducing added sugars and ultra-



processed foods, ensuring meal regularity, and expanding physical activity. Given the observed difficulty in reading/recording blood pressure, it is advisable to incorporate health literacy components (how to interpret BP values, screening frequency, meaning of measurements) and to standardize measurement protocols in school campaigns, ensuring ethical practices and informed consent.

Finally, the WHO global report (2023) underscores the urgency of population-level strategies to curb hypertension: reducing salt, sugar, and ultra-processed foods; promoting healthy institutional environments; and continuous monitoring with clear targets and indicators. The results of this study high confidence in messages and satisfaction with interventions, but behaviors still concentrated in “sometimes” and “rarely” confirm that the right path has been initiated. The next cycle should combine: curricular integration (practical didactic sequences and formative evaluation), reconfiguration of the school food environment (canteen norms, free water, accessible fruits, school horticulture), family and community engagement (continuous communication, shared challenges and goals), and monitoring with process and outcome indicators (meal frequency, fruit and water availability/consumption, prevalence of soft drinks, periodic BP screenings). In the local context, partnerships with producers and markets in Tete and Nampula could reduce cost and access barriers, connecting education to real availability.

CONCLUSION

The present article, entitled “*Evaluation of Nutritional Education Interventions in the Prevention of Arterial Hypertension Among Adolescents Aged 15 to 19 Years at Francisco Manyanga Secondary School, in the City of Tete, in 2025*”, provided a comprehensive understanding of the effectiveness of educational actions carried out with adolescents. The central research question *What is the effectiveness of nutritional education interventions in preventing arterial hypertension among adolescents aged 15 to 19 years at Francisco Manyanga Secondary School?* was addressed with evidence indicating that the interventions had a positive impact, particularly in increasing nutritional knowledge and improving attitudes, while initiating behavioral changes that remain gradual and transitional.

The results demonstrated high credibility and acceptance of the educational messages, with 67.5% of participants rating the intervention as “good.” However, eating habits remain in transition: fruit and vegetable consumption and meal regularity were concentrated in the “sometimes” and “rarely” categories, while soft drink consumption persisted predominantly as “sometimes.” Statistical analysis confirmed significant improvements in nutritional knowledge ($p < 0.01$, Cohen’s $d = 0.65$), but changes in reported behaviors and blood pressure measurements did not reach statistical significance. This distinction underscores that while knowledge and attitudes improved, measurable reductions in hypertension risk were not observed within the short intervention period.

Regarding the general objective, it can be affirmed that the study achieved its aim of evaluating the effectiveness of nutritional education interventions. The specific objectives were also addressed: the prevalence of risk factors such as irregular meals and consumption of ultra-processed foods was identified, and the relationship between acquired knowledge and healthier behaviors was partially confirmed, though clinical indicators remained unchanged.

The study demonstrates that nutritional education is effective in increasing knowledge and promoting positive attitudes, but that sustained habit change requires continuity, family involvement, and supportive policies that foster a healthy food environment. These findings converge with the literature (Costa et al., 2021; FAO, 2013; Freitas & Silva, 2020; MISAU, 2022; Monteiro et al., 2020; Popkin et al., 2021; Silva et al., 2021; Souza & Lima, 2022; WHO, 2023), which emphasizes that knowledge alone does not guarantee behavioral change.

Thus, it is concluded that the interventions carried out at Francisco Manyanga Secondary School were effective in improving knowledge and attitudes, addressed the central problem and objectives, but did not produce statistically significant changes in blood pressure. The future challenge is to transform acceptance and knowledge into consistent practices, shifting patterns from “sometimes” and “rarely” to “always.” This requires continuity of actions, integration with public policies, and engagement of the school and family



community, alongside structural measures to improve food environments and reduce barriers to healthy choices.

SUGGESTIONS AND PROPOSALS

Based on the conclusions of this study, several suggestions and proposals can be outlined to strengthen the effectiveness of nutritional education interventions in preventing arterial hypertension among adolescents at Francisco Manyanga Secondary School.

1. **Curriculum Integration:** It is essential to systematically integrate content on healthy eating and hypertension prevention into the school curriculum. This should include not only theoretical lessons but also practical activities such as school gardens, cooking workshops, and healthy habit challenges. Embedding these elements into the pedagogical routine ensures that knowledge is continuously reinforced and translated into protective behaviors.
2. **School Food Environment:** Strengthening the school food environment requires clear policies for canteens and nearby points of sale. This involves restricting the availability of soft drinks and ultra-processed foods while encouraging the presence of fruits, vegetables, and balanced meals. Collaboration with local producers and community gardens can reduce cost barriers and expand access to fresh foods, aligning with national and international health promotion guidelines.
3. **Family and Community Engagement:** The involvement of families and the community is crucial. Parents, guardians, and community leaders should participate in campaigns and training sessions to broaden the reach of interventions and reinforce habits learned at school. This shared responsibility creates a supportive environment for daily practice and reduces the risk of relapse into irregular eating patterns.
4. **Monitoring and Evaluation:** Continuous monitoring and evaluation are necessary to consolidate changes. The establishment of process and outcome indicators—such as meal frequency, fruit and vegetable consumption, reduction of soft drink intake, and periodic blood pressure screenings will allow for tracking progress and adjusting strategies as needed. This systematic follow-up ensures that intermediate behaviors (“sometimes” and “rarely”) are gradually transformed into consistent health practices.

FINAL NOTE

By integrating curriculum, school environment, family and community involvement, and monitoring mechanisms, a set of complementary actions can be created to transform the strong acceptance of interventions into lasting changes. This consolidation of healthy habits will contribute effectively to the prevention of arterial hypertension among adolescents, while also supporting Mozambique’s broader public health agenda.

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