The impact of school feeding programs on academic achievement in primary education: a case study of Nyaruguru district, Rwanda

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ABSTRACT: This study aimed to examine the impact of Rwanda's National School Feeding Programme (NSFP) on academic achievement in primary schools in Nyaruguru District. It employed a mixed methods approach, combining quantitative and qualitative data collection methods. The study had three main objectives: assessing the implementation status of the school feeding program, evaluating the academic performance of students, and determining the correlation between the program and academic achievement. Using a descriptive and correlational research design, the study analyzed data from 399 beneficiaries of the program, selected using purposive sampling techniques. Data was collected through questionnaires, interviews, and documentary reviews. Data analysis involved descriptive statistics, correlation analysis using SPSS for quantitative data, and thematic analysis for qualitative data. The study ensured reliability through detailed documentation and validity using official exam scores and triangulation of findings. The findings indicated a positive correlation between the types, frequency, quality, and quantity of meals provided and pupils' academic achievement. Respondents generally had positive views about the program, citing benefits such as meal variety, nutritional value, and positive effects on concentration, health, and well-being. Regression analysis showed that these factors moderately explained pupils' academic performance, highlighting the program's importance in enhancing academic success. In conclusion, the study found that the school feeding program in Nyaruguru district significantly contributed to pupils' academic success. It recommended regular evaluations to monitor the program's impact and identify areas for improvement.

I.   INTRODUCTION

School feeding programs (SFPs) have been implemented globally to address hunger, improve nutrition, and support education outcomes. In Sub-Saharan Africa, where undernutrition rates are high, SFPs play a crucial role in building human capital. Rwanda, like many countries in the region, faces significant challenges in addressing undernutrition and its impact on education. The National School Feeding Program (NSFP) was launched in 2009 to provide daily nutritious meals to primary school children, aiming to improve their ability to learn and reach their full academic potential. The program has shown promising results, and the Government of Rwanda has decided to scale up the NSFP nationwide. This study aims to evaluate the program's impact and gather valuable lessons to strengthen programming in Rwanda and other vulnerable communities across Sub-Saharan Africa.

The expansion of the NSFP presents an excellent opportunity to evaluate its continued impact and gather valuable lessons to strengthen programming not only in Rwanda but also in other vulnerable communities across Sub-Saharan Africa. By investing in the next generation's health and education, we can break the cycle of poverty and pave the way for a brighter future.

The study aims to contribute to Rwanda's human development goals and provide a model for other countries facing similar challenges. It is important to address under nutrition and its educational consequences, and this study will provide insights into effective strategies to promote

children's well-being and maximize their educational potential

II.   METHODS AND MATERIALS
2.1 Description of study area
Nyaruguru District in Rwanda's Southern Province is a mountainous region known for its tourist attraction, Nyungwe Forest. The district is divided into 14 sectors and covers an area of 1,010 km². The landscape is characterized by hills and peaks, with a range of altitude from 1500 to 2300 meters. The climate is influenced by the landscape, experiencing rainfall and temperature variations throughout the year. The district is divided into two river basins, Rukarara and Mwogo, and has several seasonal rivers. The soil is predominantly clay and sandy, often degraded by erosion, with acidic pH levels. Agricultural viability is limited, and soil degradation is a significant issue due to land fragmentation, over-exploitation, and poor agricultural practices. The staple crops grown in Nyaruguru include Irish potatoes, maize, wheat, sweet potatoes, climbing beans, and cash crops like coffee and tea.
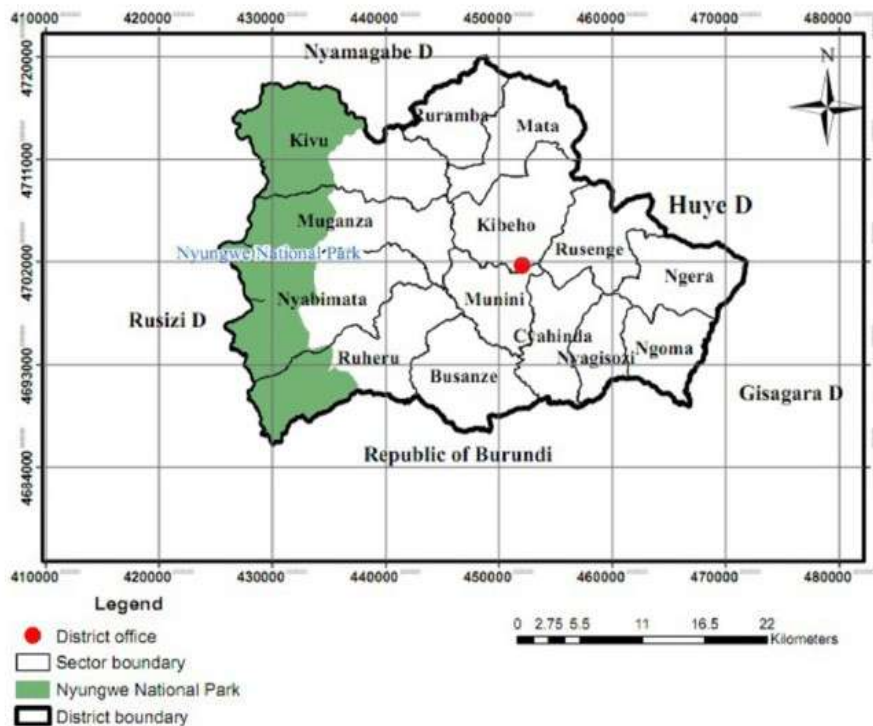
2.2 Data collection and analysis
2.2.1 Data collection
For this study, the questionnaire was tailored for teachers, pupils, parents, and the school committee members, and interviews were conducted to headteachers, to district officials and other education stakeholders.

Descriptive statistics, such as frequencies, percentages, and distribution, were employed to characterize the sample population and variables. In this study, a 5-point Likert scale was used to measure participants' responses. The scale ranged from 1 (strongly disagree) to 5 (strongly agree). Mean scores were calculated for each item, with a standard deviation indicating the level of heterogeneity or homogeneity within the responses. If the standard deviation was greater than 1, it indicated heterogeneity, while a standard deviation less than 1 indicated homogeneity (Creswell, 2009).

Qualitative data analysis, as defined by Creswell (2009), involved preparing, organizing, reducing codes into themes, and representing findings. Thematic analysis was employed in this study, which included transcription, generating initial codes, reviewing themes, and defining the final themes emerging from interview transcripts.

Quantitative data from questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, such as means and standard deviations, were calculated to summarize the data. Inferential statistics, such ANOVA, were used to examine relationships and test hypotheses. The results were presented

usingtables, and narratives to facilitate interpretation and draw conclusions.

2.2.2 Data analysis tools.

Table 1:Likelt scare.

Likelt scare	Strongly Agree	Agree	Neutral /not sure	Disagree	Strongly Disagree
Mean	Between 4.21 and 5	Between 3.41 and 4.20	Between 2.61 and 3.40	Between 1.81 and 2.60	Between 1 and 1.80

Standard deviation and mean.

Standard deviation (SD) is a statistical measure that quantifies the variability or spread of a set of data points around their mean. The analysis of standard deviation can provide insights into the homogeneity or heterogeneity of the data,

The mean scores provided an average value for each item, indicating the participants' general level of agreement or disagreement. On the other hand, the standard deviation was used to assess the heterogeneity or homogeneity within the responses. If the standard deviation was greater than 1, it suggested heterogeneity, indicating a wide variation in the participants' opinions or attitudes. Conversely, a standard deviation less than 1 indicated homogeneity, suggesting a relatively consistent pattern of responses.

III.   RESULTS

3.1. Types of meals provided.

Table 3.1 Types of meals provided (n=383)Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	$\bar{x}$	Std. D
	%	%	%	%	%		
The school provides an adequate amount of rice for students.	55.9	37.6	2.3	4.2	0.0	4.45	.73
The school provides a sufficient variety of rice dishes throughout the week.	57.4	39.7	8	2.1	0.0	4.52	.62
The school provides maize dishes that are enjoyable and nutritious.	57.4	35.8	3.7	3.1	0.0	4.47	.71
The school provides an adequate amount of maize flour for students.	57.4	41.3	1.0	0.3	0.0	4.55	.53
The school provides a variety of maize flour-based dishes that are well-prepared.	57.4	39.2	3.1	0.3	0.0	4.53	.57
The school provides potatoes that are cooked well and appealing.	60.6	36	1.8	1.6	0.0	4.55	.61

Statement	SA	A	N	D		SD	x̄	Std. D
The school provides a sufficient variety of potato dishes throughout the week.	57.4	36.6	1.8	3.1		1.0	4.46	.77
The school provides beans that are cooked well and appealing.	49.1	41	2.3	4.2		3.4	3.43	.97
The school provides a sufficient variety of vegetable dishes throughout the week.	50.4	37.6	5.7	6.3		0.0	3.55	.81
The school provides sufficient oil and salt for seasoning meals.	48.6	41.5	2.3	4.2	13	3.4	3.86	.94

Source: Primary data, 2024

The data from Table 3.1 provides insights into the perceptions of respondents regarding the types of food provided in school feeding program.

Overall, the data suggests that students generally perceive the types of food provided at school to be adequate in amount and variety, with some room for improvement in the variety of beans and vegetable dishes.

The findings are in line with that of Belot (2009), his research suggests that food quality has an impact on educational outcomes, even in a developed country where children are not undernourished. The findings emphasize the importance of providing nutritious meals in school feeding programs to enhance children's cognitive function and learning abilities. By offering healthier food options, schools can contribute to better academic performance and overall well-being.

3.2 Frequency of meal provision

Table 3.2. Frequency of meal provision(n=383)

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	x̄	Std. D
	%	%	%	%	%		
The rice is provided once a week at school	37.3	52.7	6.3	1.8	1.8	4.21	.78
One time frequency of maize provided at school in a week meets my expectations.	27.9	21.9	2.3	42.8	5.0	3.25	1.37
The two times frequency of maize flour provided at school is too low.	50.4	45.2	2.1	1.8	0.5	4.43	.64
Potatoes are sometimes provided at school.	51.4	44.9	0.0	1.3	2.3	4.41	.73
The oil is provided at school every day.	44.4	46.7	4.4	2.9	1.6	4.29	.82
The meats are never provided at school	38.1	58.2	1.0	2.3	0.3	4.31	.67
The salt is provided daily at school	45.2	52.7	0.8	0.0	1.3	4.40	.61

The vegetables are seldom provided at school	32.4	55.1	7.0	2.9	2.6	3.16	1.45

Source: Primary data, 2024

The data from Table 3.2 provides insights into the frequency of meal provision in sampled schools. To interpret the data about the frequency of meal provision at sampled schools , we can look at the mean ($\bar{x}$) and standard deviation (Std. D) for each statement.

Overall, the data suggests that respondents generally perceive the frequency of meal provision at sampled schools to be adequate for most items, except for maize and vegetables, where there is more variability in responses.

3.3. Quality and quantity of meals provided.
Table 3. 3 Quality and quantity of meals provided(n=383)
Source: Primary data, 2024

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	$\bar{x}$	Std. D
	%	%	%	%	%		
The meals provided at school are of high quality in terms of nutrition and taste.	25.1	71.3	0.0	2.6	1.0	4.16	.64
The school provides sufficient quantity of food to meet the nutritional needs of pupils.	27.9	67.9	0.5	2.6	1.0	4.19	.66
Pupils receive a balanced diet through the meals provided at school.	46.2	47.8	5.2	0.3	0.5	4.38	.64
The quality of meals provided at school has positively impacted pupils' health.	46.5	46.2	1.3	3.7	2.3	4.30	.86
Parents/guardians are satisfied with the quality and quantity of meals provided through the school feeding program.	44.6	46.5	4.7	2.6	1.6	4.30	.80
The meals provided at school are culturally appropriate and meet the dietary preferences of pupils.	36.6	57.7	2.3	2.9	0.5	4.26	.69
The school feeding program has helped to reduce malnutrition among pupils.	31.9	31.1	0.3	35	1.8	3.56	1.30

The data from Table 3.3 provides insights into the perceived quality and quantity of meals provided at sampled schools, as well as their impact on pupils' academic achievement.

Overall, the data suggests that respondents generally perceive the meals provided at school to be of high quality and meet the nutritional needs of pupils. These positive perceptions are likely to contribute to the overall success of the school feeding program and its potential impact on pupils' academic achievement.

3.4. Test scores

Table 3.4. Test scores(n=383)

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	$\bar{x}$	Std. D
	%	%	%	%	%		
Pupils who participate in the school feeding program have shown improvement in their test scores.	33.7	59.3	5.5	0.0	1.6	4.23	.69
The school feeding program has positively impacted pupils' performance in academic assessments.	41.3	54	0.0	0.0	4.7	4.27	.87
Pupils who regularly receive meals at school perform better academically compared to those who do not participate in the program.	53.5	44.6	0.0	1.6	0.3	4.49	.61
The school feeding program has contributed to an increase in the overall academic achievement of pupils.	54.3	42.3	2.1	1.3	0.0	4.49	.60
Teachers have noticed a positive correlation between participation in the school feeding program and improved test scores.	47.9	44.9	5	2.3	0.0	4.38	.69
The school feeding program has helped to close the achievement gap between students from different socioeconomic backgrounds.	48.3	45.2	3.7	2.9	0.0	4.38	.69
Parents/guardians have observed an improvement in their children's academic performance since they started receiving meals at school.	57.4	41	0.0 6	1.6	0.0	4.54	.58

Source: Primary data, 2024

The data from Table 3.4 provides insights into the perceived impact of the school feeding program on pupils' academic achievement, as measured by test scores. The mean scores for all statements related to test scores were above 4.0, indicating a high level of agreement with positive statements about the program's impact.

In conclusion, the data indicates a strong belief among respondents that the school feeding program has a positive impact on pupils' academic achievement, as measured by test scores. These findings highlight the potential of school feeding programs to improve educational outcomes and support the academic success of pupils.

The findings are in line with the assessments conducted by the Rwanda Education Board (REB) and WFP showed that the provision of daily school meals significantly increased students' academic performance and net primary attendance, surpassing national averages (REB/WFP assessments, 2021).

3.5 Dropout rate/Attendance rate

Table 3. 5 Dropout rate/Attendance rate(n=383)

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	x̄	Std. D
	%	%	%	%	%		
The school feeding program has contributed to a decrease in the dropout rate among pupils.	44.6	48.8	5	1.6	0.0	4.36	.65
Pupils who participate in the school feeding program are more likely to attend school regularly.	41.5	44.9	3.7	8.1	1.8	4.16	.95
The school feeding program has helped to improve overall attendance rates at the school.	26.4	70.5	2.1	1.0	0.0	4.22	.52
Parents/guardians are more motivated to send their children to school regularly because of the school feeding program.	28.5	70	0.0	1.6	0.0	4.25	.53
The dropout rate among pupils who participate in the school feeding program is lower compared to those who do not participate.	59.8	39.7	0.0	0.5	0.0	4.58	.52
Improved attendance rates at school can be attributed to the school feeding program.	58.7	36.8	2.1	1.8	0.5	4.51	.68
The school feeding program has helped to create a more conducive learning environment, leading to higher attendance rates.	52	38.6	6	3.4	0.0	4.39	.75
The school feeding program has helped to reduce absenteeism due to illness among pupils.	53.8	38.9	3.4	3.9	0.0	4.42	.74
The impact of the school feeding program on attendance rates is evident across all grade levels.	62.1	36	0.0	1.8	0.0	4.58	.59

Source: Primary data, 2024

The data from Table 3.5 provides insights into the perceived impact of the school feeding program on dropout rates and attendance rates among pupils.

The findings concurred with that of Afridi, (2007). According to his study conducted in India, the implementation of school feeding programs resulted in a significant increase in girl'' attendance in grade 1, with an improvement of 10.5%. The study also found that the number of girls attending grade 1 increased by 1.77% per school day and by 0.81% in grade 3 due to the provision of meals at school. However, the attendance for boys showed a positive but statistically insignificant increase in grade 1.

3.6 Progression rate/Repetition rate.

Table 3. 6 Progression rate/Repetition rate(n=383)

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	x̄	Std. D
	%	%	%	%	%		
Pupils who participate in the school feeding program are less likely to repeat a grade.	49.1	40.5	4.4	2.3	3.7	4.28	.93
The school feeding program has helped to reduce the repetition rate at the school.	50.1	43.6	2.9	2.3	1.0	4.39	.75
Parents/guardians are more inclined to support their children's education because of the school feeding program, leading to higher progression rates.	29.2	70	0.8	0.0	0.0	4.28	.46
The progression rate among pupils who participate in the school feeding program is higher compared to those who do not participate.	40.2	53.8	0.0	2.3	3.7	4.24	.87
Improved progression rates can be attributed to the school feeding program.	64	34.7	0.0	1.3	0.0	4.61	.56
The school feeding program has helped to create a more supportive learning environment, leading to higher progression rates.	64.2	32.6	1.0	2.1	0.0	4.59	.62
The school feeding program has helped to reduce grade repetition due to academic difficulties among pupils.	57.7	33.7	6.5	2.1	0.0	4.47	.71
The impact of the school feeding program on progression rates is evident across all grade levels.	55.9	35.8	2.6	3.4	2.3	4.39	.88

Source: Primary data, 2024

The data from Table 3.6 provides insights into the perceived impact of the school feeding program on progression rates and repetition rates among pupils as follows.

Overall, the means for all statements related to progression rates and repetition rates were above 4.0, indicating a high level of agreement with positive statements about the program's impact. The standard deviations varied, with some statements showing higher variability in responses than others. These findings suggest that the school feeding program is perceived to have a positive impact on reducing repetition rates, improving progression rates, and creating a more supportive learning environment.

IV.   DISCUSSIONS ONTHE RELATIONSHIP BETWEEN SCHOOL FEEDING PROGRAMS AND PUPILS' ACADEMIC ACHIEVEMENT

The third objective of this study was to assess the relationship between school feeding program and pupils' academic achievement in sampled schools in Nyaruguru district, Rwanda. To

establish the nature of how variables are related, the Pearson correlation coefficient was used and it is based on the following rules: when the Pearson correlation value is positive, it is to say that the relationship is positive, and when it is negative the relationship is said to be negative, and the Pearson correlation is 0, it is said that there is no relationship between variables. The relationship was tested basing on the significance level or p-alpha of 0.01. When the p-value in table is less than or equal to 0.01 the relationship is said to be statistically significant, and when the p-value or Sig. (2-tailed), is greater than 0.01 the relationship is said to be not statistically significant.

Table 4. 1 Correlation analysis of variables

School feeding program		Pupils academic achievement		
		Test scores	Dropout rate/Attendance rate	Progression rate/Repetition rate
Types of meals provided	Pearson Correlation	.549**	.681**	.539**
	Sig. (2-tailed)	.000	.000	.000
	N	383	383	383
Frequency of meal provision	Pearson Correlation	.574**	.736**	.630**
	Sig. (2-tailed)	.000	.000	.000
	N	383	383	383
Quality and quantity of meals provided	Pearson Correlation	.539**	.668**	.555**
	Sig. (2-tailed)	.000	.000	.000
	N	383	383	383
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: Primary data, 2024

The correlation analysis in Table 4.1 shows the relationships between the school feeding program and pupils' academic achievement, as measured by test scores, dropout rate/attendance rate, and progression rate/repetition rate. Types of meals provided: There is a moderate to strong positive correlation between the types of meals provided and pupils' academic achievement with Pearson Correlation with Test scores: 0.549**, Pearson Correlation with Dropout rate/Attendance rate: 0.681**, Pearson Correlation with Progression rate/Repetition rate: 0.539** and all correlations are significant at the 0.01 level (2-tailed).

For Frequency of meal provision: There is a strong positive correlation between the frequency of meal provision and pupils' academic achievement with Pearson Correlation with Test scores: 0.574**, Pearson Correlation with Dropout rate/Attendance rate: 0.736**, Pearson Correlation with Progression rate/Repetition rate: 0.630** and All correlations are significant at the 0.01 level (2-tailed).

For Quality and quantity of meals provided: There is a moderate to strong positive correlation between the quality and quantity of meals provided and pupils' academic achievement with Pearson Correlation with Test scores: 0.539**, Pearson Correlation with Dropout rate/Attendance rate: 0.668**, Pearson Correlation with Progression rate/Repetition rate: 0.555** and All correlations are significant at the 0.01 level (2-tailed).

Overall, the results suggest that the types, frequency, and quality/quantity of meals provided through the school feeding program are positively correlated with pupils' academic achievement, including their test scores, attendance rates, and progression rates, dropout, and repetition rates. These findings highlight the importance of the school feeding program in supporting pupils' academic success.

Since all P-values are less than 0.01and all correlation coefficients are positive, there is a statistically significant between the schools feeding

programs indicators and pupils academic achievement.

Table 4. 1 Overall Correlations

		Pupils academic performance
School feeding Program	Pearson Correlation	.689[**]
	Sig. (2-tailed)	.000
	N	383

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Primary data, 2024

Table 4.2 displays the overall correlation between school feeding program and pupils' academic achievement. The strong correlation coefficient of .689** depicted in Table 14 signifies a substantial and positive association between school feeding program and pupils' academic achievement. This association is statistically significant, as indicated by the p-value of .000, falling below the 0.01 threshold.

Regression Analysis
Regression analysis was established, and the results obtained using SPSS software is shown in the tables below.

Table 4. 2 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.715[a]	.511	.507	.30638

a. Predictors: (Constant), Quality and quantity of meals provided, Types of meals provided, Frequency of meal provision

Source: Primary data, 2024

The model summary table presents the results of a regression analysis with several predictors (Quality and quantity of meals provided, Types of meals provided, Frequency of meal provision) and an outcome variable. In this table 15, R is 0.715, indicating a moderately strong positive correlation between the predictors and the outcome variable. In this model, R² is 0.511, meaning that 51.1% of the variance in the outcome variable is explained by the predictors. The adjusted R-squared is 0.507, which is slightly lower than the R-squared value but still indicates a reasonable fit for the model. The Std. Error of the Estimate, in this case, it is 0.30638, indicating the average error in predicting the outcome variable.

Overall, the model appears to have a moderate explanatory power (R^2 = 0.511) and a reasonable fit (Adjusted R^2 = 0.507), suggesting that the predictors (Quality and quantity of meals provided, Types of meals provided, Frequency of meal provision) are moderately related to the outcome variable.

Table 4. 3 Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.174	3	12.391	132.010	.000[a]
	Residual	35.575	379	.094		
	Total	72.749	382			

a. Predictors: (Constant), Quality and quantity of meals provided, Types of meals provided, Frequency of meal provision

b. Dependent Variable: Pupils academic performance

Source: Primary data, 2024

The analysis of variance (ANOVA) Table 4.4 indicates that the regression model, which includes predictors such as Quality and quantity of meals provided, Types of meals provided, and Frequency of meal provision, is statistically significant in predicting Pupils academic performance (F = 132.010, p < 0.01). This suggests that the predictors together explain a significant amount of variance in Pupils academic performance.

Table 4. 4 Regression Coefficients

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	.836	.045		18.491	.000
Types of meals provided	.451	.053	.214	4.419	.002
Frequency of meal provision	.619	.089	.973	6.956	.000
Quality and quantity of meals provided	.477	.072	.277	4.449	.005
a. Dependent Variable: Pupils academic performance					

Source: Primary data, 2024

The regression coefficients indicate the strength and direction of the relationships between the predictors (Types of meals provided, Frequency of meal provision, Quality and quantity of meals provided) and the dependent variable (Pupils academic performance). The p-values associated with each coefficient are used to determine the statistical significance of these relationships. A p-value less than 0.05 is typically considered statistically significant. In this analysis, all three predictors have p-values less than 0.05, indicating that they are statistically significant in predicting Pupils academic performance. Specifically, Frequency of meal provision appears to have the strongest relationship with Pupils academic performance (p = 0.000), followed by Quality and quantity of meals provided (p = 0.005) and Types of meals provided (p = 0.002). These findings suggest that the frequency, quality, and variety of meals provided through the school feeding program have a significant impact on Pupils academic performance.

V. CONCLUSION
The study findings reveal that the school feeding program in Nyaruguru district, Rwanda, is perceived positively by respondents, indicating high levels of satisfaction and perceived benefits. The program's impact on pupils' well-being and academic achievement is evident, with strong agreement on the quality and nutritional value of meals, as well as their positive effects on concentration, health, and academic performance.

The analysis demonstrates significant correlations between the types, frequency, and quality/quantity of meals provided and pupils' academic achievement. These findings suggest that the school feeding program plays a crucial role in improving test scores, reducing dropout rates, and enhancing attendance and progression rates among pupils.

Overall, the study underscores the importance of the school feeding program in Nyaruguru district as a key contributor to pupils' academic success. The program's positive impact on various aspects of pupils' well-being and academic achievement highlights its effectiveness in supporting educational outcomes and fostering a conducive learning environment.

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