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RESEARCH ARTICLE

MJM BIOLABS

Dietary Practices and Nutritional Status of Adolescent Girls (13 – 18 Years) Attending Public Mixed Day Secondary Schools in Gilgil Sub-County, Nakuru, Kenya

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ABSTRACT

Adolescent girls are nutritionally vulnerable because of their bodies require high nutrients to grow, have high risk-taking propensity and are predisposed to pressure from peers. Therefore, this study's main aim is to determine the association between dietary practices and nutritional status among school-going adolescent girls. The study targeted the population of adolescent girls (13-18 years) in 34 public mixed day secondary schools in Gilgil Sub-County. A sample of 420 girls was obtained from six schools using a multi-stage sampling process. Data on dietary practices was collected using a structured questionnaire while data on nutritional status was collected using anthropometric tools. The data was summarized using descriptive statistics while the logistic regression was used to check the association between dietary practices and nutrition status at the 0.05 level of significance. Results showed that the majority of school going adolescent girls are in a healthy nutritional state based on BMI. However, 13.8% of the girls are malnourished with 6.3% being underweight, 5.3% being overweight and 2.2 being obese. Taking 1-2 meals and snacks per day (OR= 0.443, 95% CI: 0.245- 0.799), skipping meals (0.854, 95% CI: 0.318- 1.077), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a healthy nutritional status. On the other hand, observing the concept of balanced diet (OR= 2.475, 95% CI: 1.357- 4.515), taking more than 2 litres of water a day (OR= 3.402, 95% CI: 1.187- 9.750) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significantly linked to greater chances of having a healthy nutritional status. Based on the findings, the study concluded that most school going adolescent girls in the study area are in healthy nutritional status but about 14% of the girls are malnourished. Nutritional status of the girl is significantly determined by dietary practices like number of meals per day, water intake, quality and diversity of diet. The study recommends that policies and programmes aimed at improving the nutritional status of school going adolescent girls should focus on improving the girls' access to meals with diverse foods groups.

Keywords: Dietary practices, nutritional status, adolescents, girls.

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INTRODUCTION

Even though adolescents make up one-sixth of the world's population, adolescent nutrition is still a neglected issue in the majority of nations. According to the World Health Organization (2019), adolescence is the stage of life between the ages of 10 and 19 when a person transitions from a dependent childhood to an independent adulthood. Around 1.2 billion teenagers live on the planet, making up more than 18% of the entire population. Six hundred million of them are female, and about 90% of them reside in low- and middle-income nations (Igras et al., 2014).

The adolescence stage is typified by accelerated growth and development during which 15 to 25% of adult height is attained as well as up to 45% of skeletal growth (Das et al., 2019). The accelerated change in stature, muscle mass, and fat mass during this time make the risk of inadequate nutrition and other health problems a major concern. Today's adolescent females have a high frequency of chronic energy and micronutrient shortages, and this is directly related to how well the following generation will fare. Without addressing these deficits, the cycle of poverty, chronic illness, and undernutrition across generations continues. Adolescent eating habits also predict eating practices and health during adult years (Blum et al., 2019).

Evidence suggested that adolescent females are frequently a marginalized and disempowered population, which results in fewer possibilities and options for them (Hadush et al., 2021). They are a nutritionally susceptible group due to their high growth requirements, risk-taking behaviours, and eating habits. Additionally, because they are more susceptible to environmental influences and the demanding physical and mental labour typical of least developed countries, they may experience greater physiological distress and nutritional needs during adolescence. Girls are particularly vulnerable in certain cultures, from birth to adolescence, due to gender inequality (Heise et al., 2019). Furthermore, public health system accords little attention to adolescent because stakeholders often regard them as a low-risk category for poor health and nutrition. As a result, there is a shortage of knowledge about the nutritional status of adolescents, particularly those from developing countries.

In addition, the World Health Organization (2019) opines that adolescent girls face unique nutritional challenges due to physiological changes during puberty. Adolescent girls experience significant bodily changes, including increased fat deposition and skeletal growth and higher iron requirements related to menstruation, which have implications for their nutritional needs. These changes make teenage girls more susceptible to developing certain nutritional deficiencies such as iron deficiency, particularly due to increased iron requirements related to menstruation (Golley et al., 2017). This gender-specific vulnerability underscores the importance of addressing the nutritional needs of teenage girls to promote their overall health and well-being (Virdi et al., 2017).

Poor nutritional status among adolescents is widespread in developing countries as characterized by over nutrition and under nutrition emanating from changes in nutrition habits (Sharma et al., 2019). Poor nutritional status is still a central public health challenge among adolescents in Kenya (Machocho et al., 2023). The Kenya Demographic and Health Survey (KDHS) of 2022 showed that 16.6% of adolescents aged 13–18 years were thin, 12.2% were overweight or obese while 1.7% exhibited stunting (Kenya National Bureau of Statistics, 2022). Poor nutritional status puts adolescents at a risk of deprived health, below average school performance while over nutrition puts them at a risk of being exposed to lifestyle diseases and developing low self-esteem (Kamanu, 2019). Poor nutritional status at the adolescent stage also has long-term consequence including lifetime obesity, hyperlipidaemia, osteoporosis, loss of final adult height, retarded intellectual development and delayed sexual maturation (Berhe et al., 2019).

In Nakuru County, under nutrition costs the healthcare system approximately Kshs 175.6 million every year and loses amounting to Kshs 626.6 million as a result of mortality and low economic output caused by malnutrition (County Government of Nakuru, 2023). Gezaw et al. (2023) noted a lack of consistency in the information regarding factors that affect adolescent nutritional status. In their systematic literature review, Salam et al. (2020) observed that most of the studies examining factors contributing to the double burden of malnourishment among adolescence are concentrated in the European and North American regions. There is a gap in knowledge regarding factors that contribute to adolescent malnutrition in low- and middle-income countries despite the fact that 90% of adolescent live in these countries.

In addition, none of the studies reviewed by Salam et al. (2020) had adopted the gender lens in examining the malnutrition problem. Blum et al. (2019) contends that since gender norms have a major impact on nutritional habits and access in developing nations, embracing a gender lens in studying the malnutrition challenge will be of greater value. The study sought to fill these gaps by examining the association between dietary practices and nutritional status among school going adolescent girls (13 – 19 years) in Gilgil Sub County, in Nakuru County, Kenya.

MATERIALS AND METHODS

Research Design

The research made use of the cross-sectional study design. This design involved examining relationships between variables at a specific point in time, allowing the researcher to examine

associations without the need for long-term follow-up (Schmidt & Brown, 2019).

Study Area

The research was carried out in the Gilgil sub-county situated in Nakuru County, Kenya. Gilgil Sub-County was chosen for its on-going two-year pilot study of integrated weekly iron and folic supplements (WIFS) and nutrition education program for teenage females to prevent anaemia. The target population for this study were 7319 students (girls) aged 13-18 years distributed in the 34- public mixed day secondary schools in Gilgil-Sub County.

Sample Size Determination

The sample size for the study was determined using the Slovin' formula (Statistics, 2023). The sample size formula was as follows:

$$n = \frac{N}{1+(N e^2)}$$

Where
n = sample size
N= population size;
e= margin of error; taken to 5% or 0.05.
For this study, population size, N = 7319
So, sample size is given by

$$n = \frac{7319}{1+(7319 x 0.05^2)}$$

$$n = \frac{7319}{1+(7319 x 0.0025)}$$

$$n = \frac{7319}{1+18.2975}$$

$$n = \frac{7319}{19.2975}$$

= 379.27≈ 379 respondents

Thus, the sample size was rounded off to 379 since the study was dealing with human beings. A further 41 respondents equivalent to about 10% of the desired sample size were added to cater for nonresponse. Therefore, the total sample was 420 respondents.

Sampling Procedure

Respondents were selected using a multi-stage sampling process that comprised of two phases. The first phase focused on selection of schools in which the research was conducted using the stratified random sampling method. Gigil Sub-County was sub-divided into three strata in line with the three educational zones within the area: Karunga, Mbaruk/Eburu and Elementaita Zones. Random sampling technique was employed to select two schools from each zone making a total of 6 schools. The second phase of sampling focused on selecting girls within the six schools. The random sampling method was used at this stage to select 70 girls from each school.

Data Collection Instruments

Data on dietary practices was collected using a structured questionnaire. This questionnaire comprised of the Individual Dietary Diversity Score (IDDS) items with supplemental questions that assessed the number of meals that the respondent consumed daily, the daily water intake, whether the respondent skips meals, and whether the respondents were taking balanced diets (Hussien et al., 2021).
To collect data on nutritional status, a digital Seca ®813 bathroom scale was used to measure body weight while height was measured with a portable Seca ® 213 height board with a sliding head bar to the nearest 0.1 cm. The weight and height information was used to compute the respondents' BMI. The Centre for Disease Control (CDC) BMI chart was used to classify the respondents into one of four nutrition statuses using their BMI data. The four nutritional statuses include: underweight, healthy, overweight, or obese.

Data Collection Procedure

Authorization to conduct the research was obtained from Kabarak University SERC (reference number KUREC-040124), the National Commission for Science, Technology and Innovation (NACOSTI) (reference number 843243) and the Nakuru County Director of Education. A digital Seca ®813 scale was used to measure body weight barefooted and in light garments to the nearest 0.1kg. Height was measured barefooted in a standing position with a portable Seca ® 213 height board with a sliding head bar to the nearest 0.1cm. Participants stood upright, feet flat on the ground, back and buttocks straight and contacting the wall, for height measurement. All measurements were taken twice and averages computed. This information was used to compute BMI, which was used to determine nutritional status.

Data Analysis

To assess dietary practices, the researcher entered the data on the IDDS items, water intake, number of meals per day, and skipping of meals into the SPSS software. The researcher computed the frequency and percentage of respondents' who take each of the meals in the

IDDS scale as well as the frequency and percentage of girls who meet the required water intake, who take the recommended number of meals per day, and who skip meals. To process respondents' nutritional status, the researcher began by calculating the participants' BMI using the formula BMI = weight (kg) / [height (m)]^2. Respondents were grouped into four categories based in their BMI for age: underweight, normal weight, overweight, and obese. The association between dietary practices and nutritional status was tested using the logistic regression at the 0.05 level of significance.

Ethical Considerations

This study was conducted in accordance with ethical research guidelines. Ethics clearance was obtained from the Kabarak University Research Ethics Committee (Ref No: KABU01/KUREC/001/04/01/24), a data collection permit was secured from the National Commission for Science, Technology, and Innovation (NACOSTI) (Ref No: NACOSTI/P/24/33129) and the Nakuru County Director of Education (Ref No: CDE/NKU/GEN/4/1/21VOLIV/III). To ensure informed consent, researchers clearly explained the study's purpose to participants before obtaining their voluntary consent. Data collection took place after classes, between 4:00 PM and 5:00 PM, to minimize disruptions to learning. To maintain confidentiality, the questionnaires did not require participants to record their names or any other personal identifying information. For privacy protection, measurements were conducted individually in a private room. All completed questionnaires were securely stored in a lockable cabinet in a private room accessible only to the researcher. Additionally, electronic data (such as SPSS files) were password-protected and securely stored for five years, after which they would be permanently destroyed by shredding. To prevent feelings of exclusion or discrimination, particularly among students who were not selected to participate, the researcher facilitated an inclusive discussion with all students, including boys, after the data collection exercise.

RESULTS

General Information

The researcher distributed 420 questionnaires to sampled girls in six schools across Gilgil sub-county. Measurements of weight and height for all the 420 girls were also taken. After screening of the questionnaires, 42 were left out of the analysis because they had a lot of missing data. There questionnaire completion rate was thus 90.0%. About 27.5% of the respondents were Form-1 students and Form-2 students comprised a similar proportion. About 25.9% were Form 3 students while 19% were Form 4 students. Four respondents representing 1.1% of the sample were 14 year old, 40 (10.6%) were 15 years old, 115 (30.4%) were 16 years old, 93 (24.6%) were 17 years old and 126 (33.3%) were 18 years old. These results indicate that the sample was inclusive of girls of different ages. However, there was no girl aged 13 years in the sample despite this age falling within the inclusion criterion.

Dietary Practices of School-Going Adolescent Girls in Gilgil Sub-County

Dietary practices were measured using several indicators. The first was the number of meals that the respondents consumed on a typical day. Table 1 summarizes this information.

Table 1:
Distribution of Respondents by Number of Meals, Skipping of Meals, Adherence to Balanced Diet and Daily Water Intake

Dietary Practice	Categories	Frequency	Percent
Number of meals per day	1-2 meals and snacks per day	219	57.9
	3-4 meals and snacks per day	139	36.8
	5-6 meals and snacks per day	20	5.3
Whether respondent skips meal	Yes	183	48.4
	No	195	51.6
Respondent take balanced diet	Yes	218	57.7
	No	160	42.3
Amount of water intake per day	Less than 2 litres	130	34.4
	2 litres	172	45.5
	More than 2 litres	76	20/1

Results in Table 1 show that the majority of the respondents (57.9%) consumed 1-2 meals and snacks per day. About 36.8% of the respondents eat 3-4 meals and snacks per day, which is closer to the traditional meal structure. Only 5.3% of respondents have 5-6 meals and snacks per day, indicating that frequent eating is not a common practice among this group. Regarding skipping of meals, results in Table 1 illustrates that 48.4% of the respondents reported that the skip meals on a regular basis. A majority (57.7%) of respondents claim to take a balanced diet, while 42.3% do not. This suggests that there is awareness and a positive effort amongst more than half the respondents to maintain nutritional balance in their diets. However, a significant portion still reports not following a balanced diet. In terms of hydration, the majority of respondents (45.5%) drink 2 litres of water per day, which aligns with general health recommendations for adults. A significant proportion (34.4%) drinks less than 2 litres, which raises concerns regarding adequate hydration for these individuals. Only 20.1% of respondents consume more than 2 litres of water, suggesting that only a minority exceed the typical water intake guidelines, which could affect overall health. The diversity of meals consumed by the school going adolescent girls was also assessed. Table 2 presents the results.

Table 2:
Proportion of Respondents who consumed each Food Group

No	Food Group	N of Respondents (%)
1	Cereals	314 (83.1)
2	Vitamin a rich vegetables and tubers	187 (49.5)
3	White tubers and roots	188 (49.7)
4	Dark green leafy vegetables	151 (39.9)
5	Vitamin A rich fruits	219 (57.9)
6	Organ meat (iron-rich)	148 (39.2)
7	Flesh meats	159 (42.1)
8	Legumes, nuts and seeds	255 (67.5)
9	Milk and milk products	255 (67.5)
10	Oils and fats	254 (67.2)
11	Sweets	247 (65.3)
12	Coffee/ tea	319 (84.4)

Results in Table 2 illustrates that the most highly consumed food groups were coffee/ tea and cereals with 84.4% and 83.1% of the respondents reported having consumed these food groups respectively. The least consumed food group was organ meat (iron-rich) with only 39.2% of the respondents reporting having consumed this food group. This result raises concern because adolescent is a period where most girls begin to experience the menstrual flow and thus require diets that are rich in iron. Results also indicate low consumption of dark green leafy vegetables with only 39.9% of respondents reporting having consumed this food group. The girls were grouped into two categories based on their IDD score. Those with IDD score of 6 or below were placed in the below average dietary diversity category while those with scores of 7 or above were placed in the above average dietary diversity category. The threshold figure of 7 was based on the study by Willy et al. (2016) which established that the average IDD score in Kenya is 6.84 or approximately 7. Table 3 summarizes the results of this analysis.

Table 3:
Distribution of Respondents based on Dietary Diversity Score

Dietary diversity category	Frequency	Percent
Below average IDD (<7)	131	34.7
Above average IDD (>7)	247	65.3

Results in Table 3 shows that 34.7% of the respondents had below average IDD score while 65.3% had above average IDD score. These results suggest that the majority of school going adolescent girls in Gilgil have access to at least 7 food groups, which is average score across the country. However, more than one-third of the girls have an IDD score that is below average. This means that they do not have access to food groups that are accessed by the average household in the country. This may have an adverse effect on the nutritional status.

Nutritional Status of School-Going Adolescent Girls in Gilgil Sub-County

The nutritional status of the girls was assessed by taking anthropometric measurements of the girls' weight in kilograms and height in centimetres. The CDC BMI chart was then used to classify the girls as either underweight, healthy weight, overweight or obese based on the weight and height measurement. Table 4 summarizes the results of this analysis.

Table 4:
Distribution of Respondents Across the BMI Categories

BMI Category	Frequency	Percent
Underweight	24	6.3
Healthy weight	326	86.2
Overweight	20	5.3
Obese	8	2.2

Results in Table 4 illustrates that 86.2% of the respondents had healthy weight, 6.3% were underweight, 5.3% were overweight and 2.2% were obese. To facilitate further analysis of the nutritional status of the girls, the underweight, overweight, and obese categories were merged and categorized as malnutrition and the heath weight category was renamed to healthy nutritional status. Table 5 summarizes presents the results of this analysis.

Table 5:
Distribution of Respondents according to Nutritional Status

Nutritional Status	Frequency	Percent
Healthy nutritional status	326	86.2
Malnourished	52	13.8

Table 5 shows that 86.2% of the respondents were in healthy nutritional state while 13.8% were malnourished. This implies that prevalence of malnourishment among the school going adolescent girls in Gilgil Sub-County is 13.8%. This prevalence is higher than the 7.2% recorded in the study by Getahun et al. (2023), which collected data from adolescent students in Addis Ababa Ethiopia. On the other hand, the prevalence in Gilgil is lower than the 29.9% recorded by Andambi et al. (2021) in peri-urban areas of Nairobi.

Association between Dietary Practices and Nutritional Status of School-Going Adolescent Girls in Gilgil Sub-County

The association between dietary practices and nutritional status of the girls was tested using the logistic regression method. Table 6 presents the results.

Table 6:
Factors associated with Nutritional Status of Adolescent Girls

Factor	Odds Ratio	95% C.I	P Value
Number of meals per day			
1-2 meals and snacks per day (Yes/No)	0.443	0.245- 0.799	.006
3-4 meals and snacks per day (Yes/No)	1.170	1.121- 1.221	.066
5-6 meals and snacks per day (Yes/No)	1.737	0.964-3.128	.064
Skipping meals			
Skipping meals (Yes/No)	0.854	0.318- 1.077	.041
Intake of balanced diet			
Balance diet (Yes/No)	2.475	1.357- 4.515	.003
Water consumption			
Less than 2 litres water (Yes/No)	0.470	0.258- 0.857	.012
2 litres of water (Yes/No)	1.210	0.644- 2.275	.554
More than 2 litres water (Yes/No)	3.402	1.187- 9.750	.016
Dietary diversity			
IDD score (high/ low)	2.526	1.396- 4.571	.002

Results in Table 6 illustrates that taking 1-2 meals and snacks per day (OR= 0.443, 95% CI: 0.245- 0.799), skipping meals (0.854, 95% CI: 0.318- 1.077), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a healthy nutritional status. On the other hand, observing the concept of balanced diet (OR= 2.475, 95% CI: 1.357- 4.515), taking more than 2 litres of water a day (OR= 3.402), 95% CI: 1.187- 9.750) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significant linked to greater chances of having a healthy nutritional status.

DISCUSSION

Results show that the majority of adolescent girls in public day secondary schools in Gilgil Sub-County do not consume the recommended three square meals (breakfast, lunch, and dinner) and two snacks per day (Paoli et al., 2019). The proportion of girls consuming two meals or less in Gilgil is higher than the 25.9% recorded in the study by Kamanu (2019), which focused on adolescents in Ruiru Sub-County. The challenge of accessing the recorded number of meals is more severe among adolescent girls in public day schools in Gilgil Sub-County. About 36.8% of the respondents consumed 3-4 meals and snacks per day while 5.3% consumed 5-6 meals and snacks per day.

Close to half of the adolescent girls in public day secondary skip meals on a regular basis. These results are congruent with the study by Okeyo et al. (2020), which found that female adolescent students in South Africa missed breakfast more frequently than male adolescent students. The proportion of adolescent girl missing meals in Gilgil is also higher than the 33% recorded Kamanu (2019) in Ruiru Sub-County. The majority of the adolescent girls in public day secondary schools in Gilgil Sub-County adhere to the concept of balanced diet. However, there is room for improvement because more than 40% of the girls do not follow this concept. This finding is congruent with the study by Kamanu (2019) who observed that four out of ten of the adolescents in Ruiru Sub-County did not apply

the concept of balanced diet. This implies that a notable section of the adolescents in Kenya do not observe the concept of balanced diet, which could have a negative effect on their nutrition status.

Less than 50% of the adolescent girls in public day secondary schools in Gilgil Sub-County adhere to the recommended water intake of 2 litres per day. About 34.4 consume less than the recommended amount while 20.1% take more than the recommended amount. The findings are congruent with the study by Kamanu (2019) who observed that 33% of adolescent in Ruiru Sub-County consume less than 2 litres of water per day. The study also used the 24-hours recall individual dietary diversity question to assess the typical diets of the adolescent girls in Gilgil Sub-County. The mean IDD score for the respondents was 7.1323, which is higher than 4.7 recorded in the study by Abebe et al. (2023) that focused on adolescent girls in Nifas Silk Laphto in Ethiopia. The lowest score in the current study was 3 and the highest being 11. This implies that there none of the school going adolescent girls in Gilgil had consumed a diet containing all the 12 food groups.

The majority of school going adolescent girls in Gilgil Sub-County are of healthy weight. These findings are congruent with Machocho et al. (2023), who also found that 82.3% of adolescent girls in Nairobi City were of health weight. The proportion of health girls in the current study (86.2%) is however higher than the 70.1% documented in the study by Andambi et al. (2021) for adolescent girls attending day secondary schools in peri-urban areas of Nairobi City. This implies that the weight status of school going adolescent girls vary from one geographical location to the next.

Nutritional status of the girl was associated with skipping meals, number of meal per day, and diversity of diet. The finding is congruent with the study by Kamanu (2019), who found that skipping meals significantly associated with greater odds of being overweight. The findings are also congruent with those of the study by Hadush et al. (2021) who found that the nutritional status of adolescent girls in Afar region in Ethiopia was significantly associated with household food security. Household food security has an implication on the number of meals that members access in a day. The results are congruent with the study by Wiafe et al. (2023), who found that the IDD score of adolescent girls rural Ghana was associated with anaemia status. Diverse diet increases the probability of taking in essential nutrients and minerals.

CONCLUSIONS

Based on the findings, the study concludes that the majority of school-going adolescent girls in Gilgil Sub-County are not consuming sufficient nutrients to support their growth and development. Despite the majority of the girls having a positive attitude towards the concept of balanced diet, only 42% adhere to this concept. This suggests that while most girls would like to take balanced diet, the lack access to foods that would balance their meal. Despite the limitation, close to two-thirds of the girls take meals with diverse foods groups with majority having meals that contain more than 7 food groups. Concerning nutritional status, the study concludes that the majority of school going adolescent girls are in a healthy nutritional state based on BMI. However, 13.8% of the girls are malnourished with 6.3% being underweight, 5.3% being overweight and 2.2 being obese. Lastly, the study concludes that taking less than the recommended number of meals and snacks per day, skipping meals, and taking less than 2 litres of water a day were significantly associated with lower likelihood of having a healthy nutritional status. On the other hand, observing the concept of balanced diet, taking more than 2 litres of water a day and having a higher individual dietary diversity score were significant linked to greater chances of having a healthy nutritional status.

RECOMMENDATIONS

The county department of public health should partner with other stakeholders to provide resources and support to help the girls to access nutritious foods especially those from low-income households. This can be done through implementation of school feeding programmes that will ensure every girl is guaranteed at least one balanced meal per day. Other options that may be explored include cash transfers to low income households. The county department of public health should partner with other stakeholders to develop programmes for addressing malnutrition and reduce the proportion of girls suffering from malnutrition. Programmes that they ought to consider include nutrition education, food fortification, and food supplementation. This study was conducted among girls attending public day secondary schools in Gilgil Sub-County. Future studies should consider replicating the same in public boarding schools and private schools to facilitate

comparison. Future studies should also consider replicating the study in other sub-counties for comparison and to support generalization of findings.

Conflict of Interest

Authors declare no conflict of interest.

Author Contributions

GN: data collection & analysis, manuscript writing, correspondence with the journal; MM: supervision of the process, manuscript review and MW: supervision of the process, manuscript review

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