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Relationship between Menstrual Hygiene Management and Lower Reproductive Tract Infections among Adolescent Girls in Informal Settlements in Nakuru County, Kenya

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Abstract

Infections of the lower reproductive tract are a public-health concern. However, in Sub-Saharan Africa, the link between menstrual hygiene, water, sanitation and hygiene variables and lower reproductive tract infection has not been appropriately explored. This study sought to determine the menstrual hygiene management practices associated with occurrence of lower reproductive tract infections among adolescent girls in Informal Settlements in Nakuru County. The study used a community-based cross-sectional design targeting adolescent girls in informal settlements in Nakuru County. Multi-stage and simple random sampling methods were used to obtain a sample size of 385 adolescent girls. The findings showed that the proportion of lower respiratory tract infections (LRTIs) among the participants was 59.71% Regarding the menstrual hygiene management practices, adolescents who changed absorbent material more than twice a day were 0.22 times less likely to report experiencing a LRTI compared to those who changed once a day, (p=0.005), those who dried their reusable absorbent material outside the house were 0.26 times less likely to be infected with LRTI compared to those who dried inside the house, (p=0.014), and those who reported bathing > 3times during menstruation were 0.27 less likely to report occurrence of LRTI compared to those who bath once, (p=0.012). The study found significant association between type of absorbent material, frequency of changing absorbent material, frequency of bathing, presence of hand washing equipment and presence of anal cleansing material in toilets and lower reproductive tract infections. A study in this population that incorporate comprehensive microbiological and clinical assessments so as to get a better estimate of the prevalence of LRTI would be recommended, this will also support development of public health interventions.

Keywords: *Menstrual Hygiene Management, Lower Reproductive Tract Infections, Adolescent Girls*

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1.0 Introduction

The practice of menstrual hygiene management in every woman and girl around the world depends on the strategies that have been developed to manage menstruation. Personal preferences, financial capability, socioeconomic position, local customs and cultural views are all factors to consider. Knowledge on use of these techniques and level of education influence their application, which vary substantially from country to country (Rajanbir, 2018). The use of pure menstrual materials as absorbents, which can be reused or for single-use, frequency, place of replacement and accompanying blood cleansing practices with a sufficient amount of soap and water is described by WHO and UNICEF as menstrual hygiene management (WHO, 2018). The approach is influenced by the availability of water and sanitation (WASH) facilities at home, schools, or public places for disposal and the confidentiality of changes (Ravi & Kulasekaran, Care seeking behaviour and barriers to accessing services for sexual healtth probllems among women in the rural areas of Tamilnadu state in India, 2017).

Menstrual health is an essential aspect of reproductive health, linked to adverse outcomes, including absenteeism and sex transactions, but is sometimes disregarded (WHO, 2016). The practice of menstrual hygiene management still faces many social, cultural, and religious barriers, in addition. Poor menstrual hygiene practices have been linked to higher risks of sexually transmitted and reproductive tract infections, as well as the overall health of girls and women throughout their lifetimes, according to preliminary research (UNFPA, 2020). Menstrual hygiene is a significant problem that affects the dignity and well-being of women and girls, especially school-going girls. It plays a critical role in helping women and girls realize their full potential (UNICEF, 2019).

Infections of the reproductive tract are a severe public health problem worldwide, especially in low-income areas. Poor menstrual hygiene management may contribute to increase in these infections especially women of reproductive age (Flachsbarth, 2019-2021). Rural and low-income communities in Sub-Saharan Africa face difficulties with menstruation due to inadequacy of the information and lack of proper hygiene facilities. Some girls may be unable to access sanitary pads, requiring them to utilize old clothing, mattresses, cotton wool and even plastic bags for managing their menstrual blood flow (Kuhlmann, Bergquist, Danjoint, & Wall, 2019). This predisposes them to reproductive tract infections. This situation is worsened by taboos and cultural practices that accompany the discussion of menstruation and sexuality in different communities. In western Kenya, studies have shown that there is reduced water and sanitary hygiene (Alie, et al., November 2016).

Lack of access to hygiene and sanitation facilities and their link to reproductive tract infection has not been well-studied and addressed, hence this study was mooted and intended to determine whether the type of absorbent used, or culture and traditions on menstruation or lack of access to hygiene and sanitation influenced the occurrence of lower reproductive tract infections amongst adolescent girls. Therefore, the study was carried out in the informal sector of Nakuru County. Water and sanitary facilities were reported to be a difficulty in many schools and communities in Nakuru County, according to a situational analysis study by the Ministry of Health (Ministry of Health, 2020) with just 24% reporting adequate sanitary facilities. Water is transported from tanks and storage containers to many houses, while many urban residents must buy water from

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merchants. These figures provide a rudimentary image of functioning but do not include cleanliness, lockable doors, illumination, privacy, washing, changing, or safety.

Only a few studies have been done to assess the impact of menstrual hygiene management in developing countries in Africa. A study carried out on adolescent girls in a region called Odisha in India, the prevalence of RTIs was 62.4% (Belen, et al., 2018). In another study in Ethiopian urban slums, reproductive tract infections prevalence was 11% (Ayechew, et al., 2020) Nearer home, one study in Rwanda focusing on the association of menstrual hygiene management and lower reproductive tract infections found that the prevalence was at 64% (Marni, et al., 2016)

1.1 Statement of the Problem

There are few studies in Kenya on relationship between sanitary health and reproductive tract infections, for example, one done in rural Western Kenya found that the prevalence of Lower Reproductive Tract Infections was 64.9%. Nakuru is the fourth largest urban area in Kenya; over half of the populations are migrants from rural regions living in already overcrowded informal neighborhoods (KNBS, 2019). Nakuru was ranked 2nd highest in the number of reproductive tract cases and HIV/AIDS after Nairobi County (UNICEF, 2019). The population of adolescent aged between 10-19 years accounts for 22% of Nakuru population with 54.9% made up of the adolescent girls (Ministry of Health, 2019) (County Government of Nakuru, 2018). The prevalence of lower reproductive tract infections in Nakuru County was 77% in 2016 (Cucuzza, 2016). The prevalence of lower reproductive tract infections in Nakuru county was accounting for 3% and the 6th most prevalent diseases(among respiratory disease, upper respiratory tract infections, skin diseases, diarrhea, arthritis and joint pains) in Nakuru county (Nakuru County Government, 2018). Only 39% of households in the informal settlement have water sources on plot (Aquaya, 2019) There have been different studies carried out in different regions that link certain Menstrual Hygiene Management practices with a higher risk of Lower Reproductive Tract Infection (Eleen, et al., 2018) (Belen, et al., 2018) However, there is no study that has been carried out to determine the relationship between the menstrual hygiene management and the prevalence of lower reproductive tract infections in Nakuru. This study therefore, investigated the link if any between menstrual hygiene management and the prevalence of the lower reproductive tract infections in Nakuru with a view to providing scientific information for development of a policy on menstrual hygiene practices in Kenya that would assist in lowering prevalence of lower reproductive tract infections in women in the reproductive age.

1.2 Research Objectives

To determine the menstrual hygiene management practices associated with occurrence of lower reproductive tract infections among adolescent girls in Informal Settlements in Nakuru County.

2.0 Literature Review

Menarche is the onset of menstruation. It is during this time that women begin their reproductive age (WHO, 2018). This is a crucial biological phase that marks the beginning of the reproductive stage. The average age of menarche is between 12 and 13 years but varies depending on the ethnic or racial background (Mason, et al., 2013). Menstrual waste products produced by a woman require effective menstrual hygiene management to avoid RTIs. Menstrual hygiene management includes utilizing a clean menstrual management material to absorb and collect blood, which may be changed privately as needed throughout the menstruation cycle, washing the body with soap and water, and having appropriate disposal equipment.

Menstrual equipment that has been used and is no longer needed is disposed of (Budhathoki, et al., 2018). Water, sanitation, and facilities accessible at home, school, work, or community influence menstrual hygiene management behaviors. Access to these facilities varies in quality from country to country and population to population (Addis, Daniel, Yimtubezibush, & Zemenu, 2014).

Women across the world are establishing their menstrual management regimens (Kanwaljit, Rajanbir, & Ranjinder, Menstrual Hygiene Management and Waste DIsposal:Practices and Challenges faced by Girls/women of Developing countries, 2018). The practice of menstrual hygiene management still faces many social, cultural, and religious barriers. In addition, there is no evidence to measure the level and intensity of challenges faced by girls in menstrual management interventions. Poor menstrual hygiene practices have been linked to lower risks of sexually transmitted and reproductive tract infections, as well as the overall health of girls and women throughout their lifetimes, according to preliminary research (UNFPA, 2020). Poor menstrual hygiene management has severe consequences for adolescent health and development; this hinders the education and empowerment of women in low- and middle-income countries (Flachsbarth, 2019-2021). This situation affects almost 50% of the world's population, which raises the attention of teachers, politicians, and government and non-government officials to mediate their adverse consequences (Kanwaljit, Rajanbir, & Ranjinder, Menstrual Hygiene Management and Waste DIsposal:Practices and Challenges faced by Girls/women of Developing countries, 2018).

The type of absorbent material used, the frequency of changing the material, the accompanying body washes, and the technique of washing, drying and storing reusable towels all influence menstrual hygiene management practices. Water, sanitation, and sanitation facilities accessible in public areas and at the household level influence these habits; the quality of these facilities varies widely from nation to nation. Practices can be unhealthy and uncomfortable in low-income neighborhoods with poor access to water and sanitation. As a result, it has been associated with various lower reproductive system infections and psychological stress (Christian, et al., 2016).

Water and Sanitation Hygiene (WASH) at any level directly impacts the management of menstrual hygiene for women and girls at the school level. There are inadequate WASH facilities especially in public places such as schools, workplaces and health centers (Belen, et al., 2018). A private place to wash or change girls' clothes is determined by setting up a washing machine or girls' changing room that includes at least one toilet with a lockable door with a sink with tap and soap or detergent. A good bathroom has a roof, walls without openings, doors, and solid ventilated floor panels (John, Jamie, Yves, & Jackie, 2019)

The severity of lower reproductive tract infections is very severe in women because these infections are often asymptomatic. The morbidity and mortality associated with RTIs deprive society of the significant of contribution in developing and industrialized countries. According to epidemiological data, the incidence and prevalence of various lower reproductive tract infections vary significantly from country to country and even between regions within a country, reflecting differences in pathogen characteristics as well as behavioral, biological, medical, social, and economic factors (Christian, et al., 2016). As a result, RTI exposure is a severe public health issue worldwide, especially in low-income nations, where this amount of exposure can be linked to inadequate menstrual hygiene habits and not to STDs. Attempts to confirm this is due to simultaneous infections from multiple sources. Bacterial vaginitis and vulvovaginal candidiasis are believed to be more common due to poor menstrual hygiene (Belen, et al., 2018).

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The literature shows gaps in menstrual hygiene management for women and girls at home and the community level, especially in low-income areas. Knowledge about the relationship between menstrual hygiene management and lower reproductive tract infections is still limited. In addition, the literature reviewed indicates that the research conducted is insufficient to measure the impact of improving MHM on society or health parameters (Margret L, et al., 2017). Therefore, this study aimed to examine the relationship between menstrual hygiene management and lower reproductive tract infections in girls in an informal village in Nakuru County. This enriches the body of knowledge in this area of study.

3.0 Methodology

The study used a community-based cross-sectional design targeting adolescent girls in informal settlements in Nakuru County. Multi-stage and simple random sampling methods were used to obtain a sample size of 385 adolescent girls. Focus group discussions (FGDs) and Semi-structured questionnaires were used to obtain the information from the adolescent girls, teachers, mothers and community gatekeepers on menstrual hygiene management while self-report symptoms according to the questionnaire were used to determine the presence of lower reproductive tract infections. The relationship between menstrual hygiene management and lower reproductive tract infections was tested using Odds Ratio at a 95% confidence interval and statistical significance was set at $p < 0.05$.

4.0 Results and Discussion

4.1 Menstrual Hygiene Understanding and Management Practices

4.1.1 Understanding of Menstrual Hygiene

To assess the understanding of the adolescents' study subjects on menstrual hygiene, the sampled girls were probed on their knowledge on menstruation, the responses given indicated that 225(66.18%) defined menstruation as being the "Controlling of blood during menstruation", 75(22.06%) understood menstruation as the "Effective management of menstrual bleeding" while the rest 40(11.76%) cited menstruation as being the "Treating of the female disease" as shown in Figure 1.

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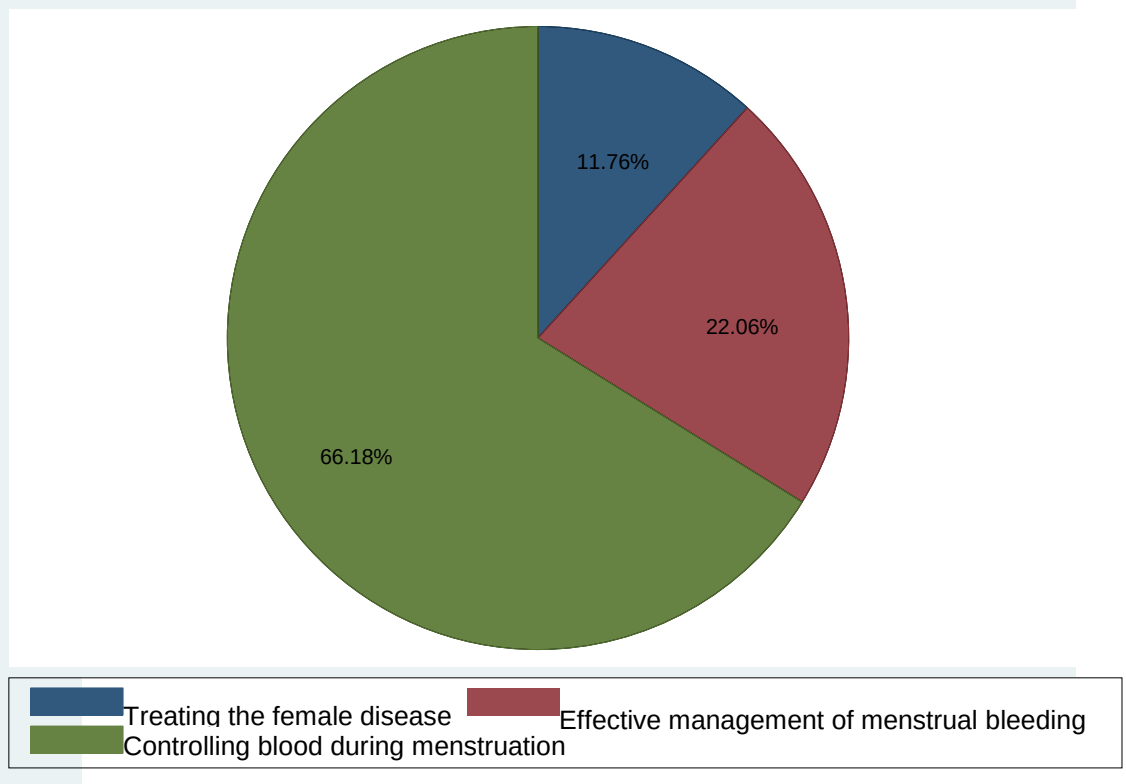

Figure 1: Understanding of Menstrual Hygiene

4.1.2 Knowledge on different menstrual management materials

Majority 294(86.45%) of the sampled adolescent girls had ever heard of disposable sanitary pads, 22(6.39%) had heard about Tampons, 14(4.11%) had heard about menstrual cup while 10(3.0%) had heard of reusable pad as shown in Figure 2.

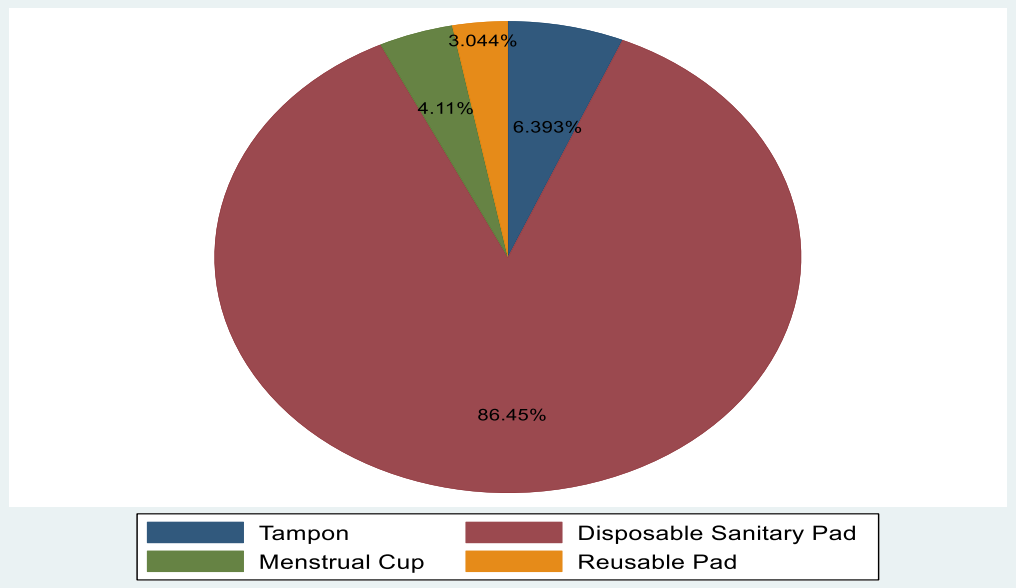

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Figure 2: Knowledge on different menstruation management products

4.1.3 Type of absorbent material used

The findings indicated that majority 309(90.97%) cited ready-made sanitary pads while 28(8.1%) cite a clean piece of cloth kept separately for the purpose and the rest 3(0.93%) indicated that any type of cloth available could be used as illustrated in Figure 3.

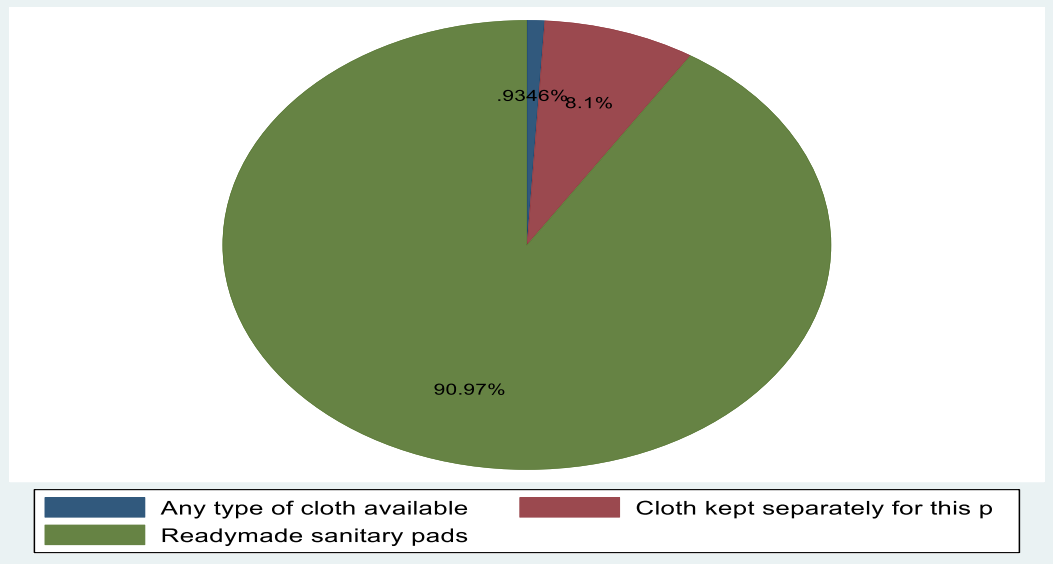

Figure 1: Type of Menstrual Absorbent Used

4.1.4 Frequency of changing absorbent material and disposal

Majority 264(77.74%) of the respondents changed their menstruation absorbent more than twice in a day, 41 (12.12%) indicated twice a day, 5 (1.37%) once a day while the rest 30 (8.77%) preferred not to say, figure 4.

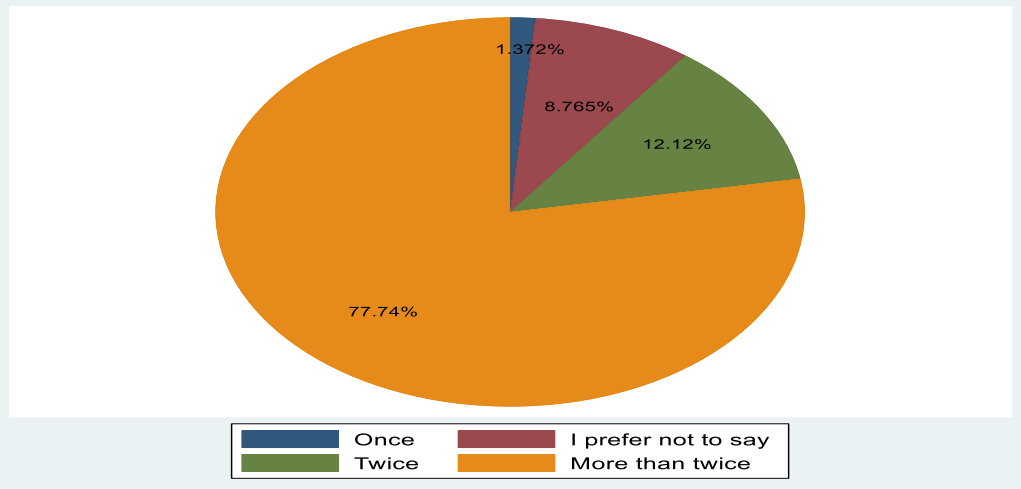

Figure 2: Frequency of changing Absorbent

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4.1.5. Disposal or Re-use the Absorbent Material

According to the findings in figure 4.6 below, it was observed that majority 326 (95.97%) indicated they disposed menstruation absorbent while 14(4.03%) indicated that they did not.

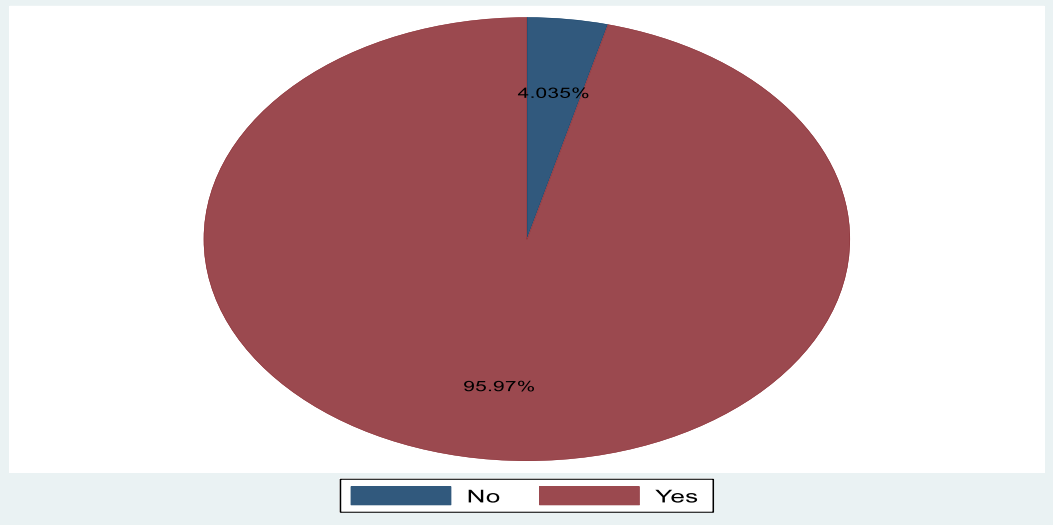

Figure 3: Disposal of Used Absorbent Material

4.2 Adolescents' Knowledge on what Constitutes 'Good Menstrual Hygiene Practices'

Using the 5 point Likert scale, 168(49.4%) strongly agreed with the statement that they had good knowledge on menstruation, with a mean of 1.95 and a standard deviation of 1.11. Similarly majority 274 (80.6%) of the respondents strongly agreed they properly disposed menstruation absorbent material in appropriate places. Regarding the storage of menstruation absorbent material in a clean place, 192(56.5%) of the sampled respondents strongly agreed.154 (45.3%) of the sampled respondents also strongly agreed that they cleaned themselves each time they change menstruation absorbent materials. However, on average majority did not cleanse themselves each time they changed. Lastly,138 (40.6%) indicated that they cleaned themselves with clean water only in their genitals as indicated, deviation of 1.5, however on average most of the girls did not clean their genitals with soap and water.

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Table 1: Understanding of Menstrual hygiene practice

Menstrual Hygiene Statement	1 F (%)	2 F (%)	3 F (%)	4 F (%)	5 F (%)	$\bar{X}$	SD
I have good knowledge about menstruation	175(51.5)	91(26.8)	65(19.1)	9(2.7)	0(0.0)	1.72	.861
I have knowledge about menstruation absorbent material	168(49.4)	67(19.7)	62(18.2)	40(11.8)	3(0.9)	1.95	1.11
I make sure I properly dispose menstruation absorbent material in appropriate place such as Pit latrine or disposal bin	274(80.6)	52(15.2)	9(2.7)	5(1.5)	0(0.0)	1.25	0.574
I make sure that I store menstruation absorbent materials in a clean place	192(56.5)	57(16.8)	15(4.4)	49(14.4)	27(7.9)	2.01	1.385
I clean myself each time I change my menstruation absorbent materials.	154(45.3)	85(25.0)	38(11.2)	63(18.5)	0(0.0)	2.03	1.14
I clean myself with only clean water in my genitals	138(40.6)	26(7.7)	77(22.7)	30(8.8)	69(20.3)	2.61	1.57
Aggregate score						**1.94**	**1.107**

Key: 1 - Strongly Agree, 2 - Agree, 3 - Not sure, 4 - Disagree, 5 - Strongly Disagree, $\bar{X}$ - Mean, SD – Standard Deviation

4.3 Water and Sanitation Hygiene

This study sought to establish the availability of water and sanitation facilities in their area of residence and how it impacted their menstrual hygiene practice. One hundred and ninety-one (56.2%) of the sampled respondents strongly agreed that the lavatory/toilet functional/usable. The respondents also reported that the lavatory/toilet is always kept clean with 205(60.3%) strongly agreeing that the lavatory/toilet is always kept clean.

One hundred and forty-five, 145 (42.7%) of the respondents also cited that the lavatory/toilet does not have a bad smell with a mean ($\bar{X}$**)** of 2.35 and standard deviation of 1.404. Regarding the availability of working hand washing equipment with water and soap for use after visiting the toilet, majority of the respondents 161(47.4%) strongly agreed with this statement, with a mean ($\bar{X}$**)** of 2.29 and standard deviation of 1.439

Regarding the availability of any anal cleansing materials available in the functional lavatory/toilet, 108(31.8%) of the respondents strongly agreed with the statement. This was evident as cited by a mean ($\bar{X}$**)** of 2.64 and standard deviation of 1.437. However, on average anal cleansing materials were not available.

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Table 2: Water and Sanitation Hygiene

Statement	1 F (%)	2 F (%)	3 F (%)	4 F (%)	5 F (%)	$\bar{X}$	SD
The lavatory/toilet functional/usable	191(56.2)	109(32.1)	23(6.8)	9(2.7)	8(2.4)	1.62	0.901
The lavatory/toilet is always kept clean	205(60.3)	73(21.5)	42(12.4)	20(5.9)	0(0.0)	1.64	0.913
The lavatory/toilet does not have a bad smell	145(42.7)	47(13.8)	62(18.2)	54(15.9)	32(9.4)	2.35	1.404
There is a working hand washing equipment with water and soap for use after visiting the toilet	161(47.4)	37(10.9)	63(18.5)	41(12.1)	38(11.2)	2.29	1.439
There any anal cleansing materials available in the functional lavatory/toilet	108(31.8)	55(16.2)	80(23.5)	44(12.9)	53(15.6)	2.64	1.437
Aggregate score						**2.09**	**1.216**

Key: 1 - Strongly Agree, 2 - Agree, 3 - Not sure, 4 - Disagree, 5 - Strongly Disagree, $\bar{X}$ - Mean, SD – Standard Deviation

4.4 Prevalence rate of LRTI

The proportion of adolescents who reported experiencing lower respiratory tract infections (LRTIs) during or shortly after menses in the informal settlements of Nakuru County was 59.71%, Figure 6.

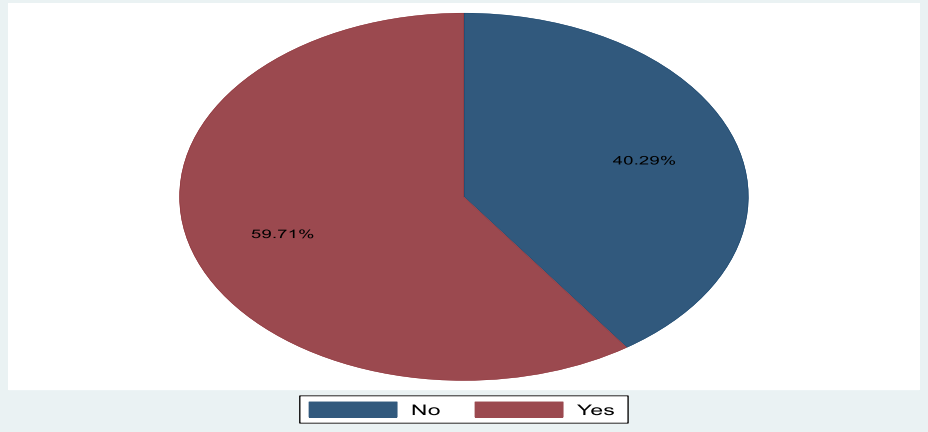

Figure 4: Prevalence of LRTI

For those who reported a LRTI the prevalent symptom was pain during urination with, 66(32.51%) of the participants suffered these symptoms the most.

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Table 3: Symptoms of LRTIS

Have you suffered or experienced any of the following symptoms in the past sick	Freq.	Percent
Pain during urination	66	32.51
Bad odor with discharge	39	19.21
Pain in the vagina	32	15.76
Genital sores (ulcers)	19	9.36
Vaginal itching	17	8.37
Irritation in the vaginal area	11	5.42
Thick white discharge	10	4.93
Yellow discharge	9	4.43
Total	**203**	**100.00**

4.5 Chi- square Test of Association

4.5.1 Menstrual hygiene practices and LRTIs

At 95% confidence it was established that there is a significant relationship between frequency of bathing and lower reproductive tract infections during menstruation ($p= 0.032$), what they use while bathing ($p< 0.0001$) and whether they dispose absorbent material ($p=0.002$).

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Table 4: Cross tabulation of Menstrual Hygiene Practices and LRTIS

Independent variables (Menstrual Hygiene Practices)		Dependent variable (LRTIs)			Chi-Square Tests		
		No	Yes	Total		Value(df)	p-Value
Frequency of changing absorbent	Once	5(56%)	4(44%)	9(100%)	a b	7.522(3)	0.057 0.053
	Twice	16(30%)	37(70%)	53(100%)			
	More than twice	111(44%)	144(56%)	255(100%)			
	I prefer not to say	5(22%)	18(78%)	23(100%)			
Frequency of bathing during menstruation	In the morning and evening	92(41%)	131(69%)	223(100%)	a b	6.2442(2)	0.044** 0.032
	Morning, lunchtime, and evening	45(42%)	63(58%)	108(100%)			
	In the evening only	0(0%)	9(100%)	9(100%)			
Bathing materials	Water only	25(100%)	0(0%)	25(100%)	a b	56.899(5)	0.000** 0.000
	Water and soap	25(38%)	41(62%)	66(100%)			
	Water, cloth, and soap	36(26%)	104(74%)	140(100%)			
	Hot water only	5(36%)	9(64%)	14(100%)			
	Hot water, and soap	11(73%)	4(27%)	15(100%)			
	Hot water, soap and a cloth	35(44%)	45(56%)	80(100%)			
Dispose or re-use absorbent	Yes	130(39%)	203(61%)	333(100%)	a b	10.59(1)	0.001** 0.002
	No	7(100%)	0(0%)	7(100%)			
Total		**137(40%)**	**203(60%)**	**340(100%)**			
Key; a=Pearson test b= fisher's exact *= significant **=fisher exact							

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4.5.2 Association between Re-usable Menstrual Absorbent Materials and LRTIs

Association test between reusable menstrual absorbent, management practices and Lower reproductive tract infection were conducted as shown in the table below. At 95% level of confidence, it was established that there is a significant relationship between lower reproductive tract infection and where they dry cloth/material used (p-0.013).

Table 5: Association between Re-usable Absorbent Materials and LRTIs

Independent variable		Dependent variable(LRTIs)				Chi-Square Tests	
		No	Yes	Total	test	Value (df)	P-Value
Where do you dispose materials used during menstruation?	Pit latrine	89(38%)	148(62%)	237(100%)	a b	4.8058(2)	0.090 0.087
	River	0(0%)	5(100%)	5(100%)			
	Disposal bin	41(45%)	50(55%)	91(100%)			
If you reuse this cloth/material, where do you preserve/keep it for the next use?	Normally, like other clothes	8(62)	5(39)	13(100)	a b	2.404(2)	0.301 0.333
	Inside the bathroom	5(36)	9(64)	14(100)			
	I prefer not to say	5(36)	9(64)	14(100)			
Where do you dry your cloth/material used?	Inside the house but hiding somewhere	9(69%)	4(31%)	13(100%)	a b	11.7512(4)	0.019** 0.013
	In the house but an open place	8(50%)	8(50%)	16(100%)			
	Outside the house and in the sunlight	65(45%)	80(55%)	145(100%)			
	Outside the house but hiding somewhere	24(38%)	40(62%)	64(100%)			
	Inside the toilet	0	9(100%)	9(100%)			
Total		**137(40%)**	**203(60%)**	**340(100%)**			
Key; a=Pearson test, b=fisher's test, *=significant p-values **= fisher exact							

4.5.3 Association between Type of Absorbent and LRTIs

Test of association between type of absorbent and Lower reproductive tract infection as shown in the table below. At 95% confidence interval it was established that there is a significant relationship between LRTI and Knowledge about menstruation material (P-value 0.001), knowledge on the ideal material used during menstruation (P-Value 0.006), and type of absorbent material they have heard of (P-value 0.000).

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Table 6: Association between Type of Absorbent and LRTIs

Independent variable		Dependent variable (LRTIs)			Chi-Square Tests		
		No	Yes	Total		Value(df)	P-Value
Type of absorbent material	Cotton	0(0%)	4(100%)	4(100%)	a	2	0.073
	Sanitary pad	137(41%)	199(59%)	336(100%)	b		0.076
Which products have you heard of	Tampon	23(55%)	19(45%)	42(100%)	a	17.5693(3)	0.001**
	Disposable Sanitary Pad	109(38%)	175(62%)	284(100%)	b		0.000*
	Menstrual Cup	0(0%)	9(100%)	9(100%)			
	Reusable Pad	5(100%)	0(0%)	5(100%)			
Ideal material used during menstruation	Any type of cloth available	0(0%)	9(100%)	9(100%)	a	9.0903 (2)	0.011**
	Cloth kept separately for this purpose	21(54%)	18(46%)	39(100%)	b		0.006*
	Readymade sanitary pads	116(40%)	176(60%)	292(100%)			
Total		137(40%)	203(60%)	340(100%)			
Key; a=Pearson test, b=fisher's test, *=significant p-values **=fisher exact							

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4.5.4 Association between WASH and LRTIs

The association between wash and LRTI was conducted at 95% confidence level as shown in the table below. It was established that there was a significant relationship between LRTI and presence of anal cleansing material (P- Value 0.046), Working hand washing equipment with water and soap for use after visit (P-value 0.019).

Table 7: Association between WASH and LRTI

Independent Variable		Dependent Variable (LRTIs)			Chi-Square Tests		
		No (%)	Yes (%)	Total (%)	test	Value(df)	P-Value
Functional lavatory/toilet	Yes	124(41%)	176(59%)	300(100%)	a	1.1447(1)	0.285
	No	13(33%)	27(57%)	40(100%)	b		0.308
Clean lavatory/toilet	Yes	114(41%)	164(59%)	278(100%)	a	0.3222(1)	0.570
	No	23(37%)	39(63%)	62(100%)	b		0.668
No bad smell in the Lavatory/toilet	Yes	76(40%)	116(60%)	192(100%)	a	0.0926(1)	0.761
	No	61(41%)	87(59%)	148(100%)	b		0.824
Functional hand washing equipment with water and soap	Yes	70(35%)	128(65%)	198(100%)	a	4.8101(1)	0.028**
	No	67(47%)	75(53%)	142(100%)	b		0.019*
Presence of anal cleansing materials in the lavatory/toilet	Yes	75(46%)	88(54%)	163(100%)	a	4.2555(1)	0.039**
	No	62(35%)	115(65%)	177(100%)	b		0.046*
Total		**137(40%)**	**203(60%)**	**340(100%)**			
Key; a=Pearson test, b=fisher's test, *=significant p-values **=fisher exact							

4.6 Discussion

4.6.1 Menarche Information

Majority of the girls were between age 10-13years, 14-16years. These findings are in agreement with a study by (Kanwaljit, Rajanbir, & Ranjinder, Menstrual Hygiene Management and Waste DIsposal:Practices and Challenges faced by Girls/women of Developing countries, 2018) which found that the age of adolescent girls in menarche ranged from 10 to 15 years with majority falling between 12 and 15 years of age. This is also similar to a study conducted in urban areas of Cameroon which cited the menarche average age as 12-15years (Atem.B, et al., 2020). The mean age of menarche of the respondents was 12.5 years. According to (Bagga & Kulkarni, 2017) the average age of menarche is consistent across population that is between 12-13 years. A similar study conducted by (Belen, et al., 2018) reported that the age at menarche in girls ranged from 12 to 17 years, with majority number falling between 13 to 15 years of age, whereas (Eleen, et al., 2018) reported the mean age at menarche to be 13 years. According to (ACOG Clinical, 2016). Menstrual cycles are often irregular during adolescent, particularly, the interval between menarche and the second cycle which would range between 21-45days. This explains the 5.6% in our results.

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4.6.2 Menstrual hygiene management practice

On average majority of the girls interviewed did not have adequate knowledge on menstruation? The difference in knowledge on, 'what is menstruation', maybe because of the source of information. Probably girls were not given detailed information on menstruation. The varied understanding of menstruation definition indicated that there is a population of adolescent girls who are yet to fully understand what menstruation is and how to effectively manage it. These might have been as a result of young age of the sampled girls with some of them not having received any information on menstruation, hence not clearly understanding the concept. A high level of knowledge on menstrual hygiene was associated with lower cases of lower reproductive tract infections, with 64 % reporting to have not contracted an infection among those who had a deep understanding of menstrual hygiene (Venkatraman & Sheila, 2017). It was noted good knowledge on menstruation was protective against reproductive tract infections. Different studies show that education aids in preventive measures as people are better prepared to prevent a disease (Belen, et al., 2018), (Adan, Amete, Delayehu, & Yeshiwrk, 2017), (Budhathoki, et al., 2018).

Majority of the girls used readymade sanitary pads as material. Disposable sanitary pads are what are largely used because it has the highest market share of any other menstrual commercial product. This was also confirmed by the mothers, caregivers and teachers that the disposable sanitary pads was the most common because it was readily available and also what was issued by the Kenyan government to schools. (Alexandra, Lakshmi, Perri, Francesca, & Kyle, 2016). A study done in rural Western Kenya found out that 75% of the school girls used disposable sanitary pads and 25% use tradition method The difference in the findings varies based on the strength of taboos surrounding the taboos and also because the study was in the rural areas. However, we can relate from the study and also it would imply awareness on disposable sanitary pads as increased, as shown from our results.

Majority of the respondents changed their menstruation absorbent more than twice in a day, this was also confirmed by their mothers, teachers and caregiver/spouse that most of the girls that they changed more than twice from the focus group discussion. This study is in line with a study done in Gambia, where 76.7% changed more than twice a day, 20% twice and only 6.1% once a day (Julie, et al., 2021) The probable reason for changing twice or once in a day would be because of, lack of water, ignorance, lack of an extra material or absence of disposing area. From the focus group discussion, it was confirmed that those that change twice or once lacked absorbent material to change or the environment is not conducive to change. On the other hand, the once who did it more than two times a day were not hindered by any of this and had good knowledge on menstruation, in-line with (Renata & Jackson.M, 2021).

Majority of the girls used disposable menstrual absorbent, this showed that reusable pad are not widely known to the adolescent girls. This also shows that the source of information about menstruation is not adequate; this was confirmed through focus group discussion that most mothers, caregivers were not aware of any reusable materials in the market apart from the traditional methods. Most of the girls have heard of disposable sanitary towels maybe because it is what is readily available in the market. This is an indication that a huge number of the girls prefer disposable pads over re-usable materials. It is in line with a study in Malawi where it was found out girls preferred the disposable sanitary towels (Christabel.K, et al., 2020). There was a small number that used reusable pads.

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It was also observed that on average toilets are functional usable and are always kept clean. However, on average it shows that, lavatory/toilets have bad smell and didn't have working hand washing equipment. This would be explained by low-income area setting and lack of adequate water and resources in these informal settlements. Teachers in school and mothers during focus group discussion confirmed that hygiene of the toilet was a challenge because of the lack of enough water and no enough toilets depending on the number of people in the locality.

On average, majority of the adolescent girls properly disposed menstruation absorbent material. This is in line with a study done in India that in slum areas, women dispose their waste in Pit latrines, as burning and burying is limited due to limited privacy space (Kanwaljit, Rajanbir, & Ranjinder, Menstrual Hygiene Management and Waste DIsposal:Practices and Challenges faced by Girls/women of Developing countries, 2018).

Majority (59.4%) cleaned themselves each time they changed their absorbent materials however on average most of them did not. This could be explained by the difference in access to adequate sanitary facilities (water and lavatories) in homes. This is lower than a study done in Ethiopia where 62,4% girls cleaned every time they changed (Addis, Daniel, Yimtubezibush, & Zemenu, 2014) This is lower than a study done in Ethiopia (69.5%) (Seifadin, Wakeshe, Abuzumeram, & Aubeker, 2018) and in Kenya (47.8%) (Alie, et al., November 2016). This variation would be related to the difference in cultural beliefs and availability if sanitation facilities.

5.0 Conclusion

Menstrual hygiene management is important in reducing incidences of lower reproductive tract infections. This ensures there is a reduction in school absenteeism and the burden of disease. In this study, it was established that majority of the respondents were aware of what the menstrual cycle is and also majority of the respondents had the correct understanding of menstrual hygiene management.

The study found significant association between the type of absorbent material used, the frequency the absorbent material used is changed, and the level of hygiene during menstruation and the chances of reporting a lower reproductive infection. Low incidences of infections were experienced among respondents who changed their sanitary pads more than twice a day. The type of absorbent material used was surprisingly not associated with incidences of lower reproductive tract infections.

6.0 Recommendations

There is need to incorporate more comprehensive microbiological and clinical assessments so as to get a better estimate of the prevalence of LRTI in this population.

Nakuru County policy makers and administrators should come up with effective programs and policies that will influence good MHM practices among girls in the slums by understanding their challenges to meet good MHM practices.

The health facility within the slums should educate the women and girls in the informal settlements on reproductive health.

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