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MILK CONSUMPTION PATTERNS OF CHILDREN FROM DAIRY AND NON-DAIRY HOUSEHOLDS IN NAKURU COUNTY, KENYA

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ABSTRACT: *Consumption of milk by children below five years has been on the decline especially in developing countries. This is despite it being a rich source of proteins and containing all the essential amino acids and other nutrients. The aim of this study was to establish the milk consumption patterns of children (24-59 months) from dairy and non-dairy households from peri-urban (Bahati) and rural (Olenguruone) areas in Nakuru County. A cross-sectional study was conducted in the households using semi-structured questionnaires. A multi stage cluster sampling was applied and 216 households with primary caregivers and at least one child aged 24-59 months randomly settled. Chi-square and T-tests were used to compare differences between means of dairy and non-dairy households in peri-urban/ rural areas. Multiple linear regression tests were performed to determine the relationship between socio-economic characteristics, child dietary diversity and milk consumption of children at α=0.05 level of significance. Findings indicated that milk tea was the common form of milk consumed in all households (DHs, NDHs) in both peri-urban and rural areas. The prevalence of milk consumption among children based on data from the food groups was (57.4% in DHs vs 40.3% in NDHs) in peri-urban while in the rural area 80.3% (DHs) and 72.2% (NDHs) of the children had consumed milk in the previous day. The rate at which the children consumed milk however did not translate to the actual amounts which were low. Children's mean intake of milk was 285.5±214.6 mls in DHs and 222.3±90.6 mls in NDHs while in peri-urban and rural areas the mean intake was 215.7±85.6 mls and 292.4 ± 216.6 mls respectively. This was far below the WHO minimum recommended intake of 500mls per day. Children's mean intakes of milk were significantly different among the DHs vs NDHs (0.005) and peri-urban vs rural areas (0.001). The linear regression model revealed that having a dairy cow increased the daily milk intake by children. Based on the study findings there is need for nutrition interventions that would promote consumption of milk in children.*

KEYWORDS: Milk Consumption, Dairy Households, Non-Dairy Households, Children, Caregivers.

INTRODUCTION

Despite the decline in the global rates of malnutrition among children below five years, the number of malnourished children remains high particularly in Africa and Asia (UNICEF *et al.*, 2015). Approximately 151 and 51 million children were stunted and wasted in the world in 2017 respectively. The number of stunted children aged below five years in Africa increased from 50.6 million in 2000 to 58.7 million in 2017 (UNICEF *et al.*, 2018). Findings from the 2014 Kenyan Demographic Health Survey (KDHS) showed that 26% of

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children aged below five years were stunted, 11% underweight and 4% wasted (KNBS and ICF, 2015). Estimates from the same KDHS further indicated that 27.6% of the under-fives in Nakuru County in the South Rift region of Kenya were stunted, 10.2% underweight and 4.5 % wasted (KNBS and ICF, 2015).

Causes of malnutrition are multiple, complex and interrelated (Abera *et al.,* 2017) with inadequate intake of food and diseases as the immediate causes (UNICEF, 2016). Consumption of diets that lack diversity has been showed to be one of the factors contributing to inadequate nutrient intake, consequently contributing to the burden of malnutrition among infants and young children (Dewey, 2005). Lack of dietary diversity is a problem, particularly in developing countries, where children aged below five years subsist on diets that are predominantly starch staples, bulky with high fiber and phytates that lower the bioavailability of micronutrients (Neumann *et al.,* 2002; Neumann *et al.,* 2007; Walton *et al.,* 2012; Dewey, 2013).

Children below five years need more foods that are nutrient dense compared to adults to meet their increasing nutrient requirements. Hence, a variety of foods need to be feed to them to ensure that all their nutrient needs are met (Dewey, 2013). WHO recommends timely introduction of a variety of foods, in adequate amounts and increasing frequency with age, plus continued breastfeeding to children starting from the age of six months (Dewey, 2005). A diet that is highly diversified contains both macronutrients and micronutrients (Kennedy *et al.,* 2011) which are essential in growth and development of children. ASFs provide essential micronutrients and macronutrients that are important for alleviating under-nutrition among children aged below five years, particularly in the developing countries (Jin and Iannotti, 2014). Therefore, young children should be fed frequently on small amounts of ASFs including meat, poultry, fish, eggs and milk (Dewey, 2005).

Findings from a study in western Kenya found that after a nutrition education intervention more children (6-17 months) from the intervention's group compared to the control group consumed legumes, nuts and seeds (74.5% vs 39.2%), dairy products (91.8% vs 74.2%), flesh foods (71.8% vs 42.3%), vitamin A rich fruits and vegetables (60.0% vs 33.0%) and other fruits and vegetables (70.0% vs 45.4%). The study further noted that the overall consumption of ASFs by children was low (Waswa *et al.,* 2015). The 2014 KDHS indicated that in Kenya children aged 6-23 months were commonly fed on grains (80%), fruits and vegetables rich in vitamin A (64%) while roots and tubers (38%), other fruits and vegetables (33%), legumes and nuts (25%), flesh foods (21%), eggs (17%) and dairy products (13%) were scarcely consumed. These studies indicate the need to address the poor intake of ASFs.

Milk is a rich source of proteins and contains all the essential amino acids and other nutrients including vitamins A, D, B_6, B_{12}, B_2, calcium, phosphorus, magnesium, iodine and zinc (Dror and Allen, 2014; Rawlins *et al.,* 2014). These nutrients are bioavailable ensuring better absorption and metabolism among young children, resulting to growth and development (Neumann, 2002). Milk is also cheap and requires little preparation compared to other ASFs (Hoddinott *et al.,* 2014). A daily milk intake of at least 500mls is recommended for children aged 24-59 months to enable them meet 50% or more RNIs (WHO and FAO, 2004; Dror and Allen, 2014).

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Annual milk production in Kenya has increased from 3.2 billion litres in 2003 to 5.2 billion litres in 2013 (KDB, 2014). Milk consumption in Kenya has equally increased though the capita intake of 100 litres is below the recommended 220 litres by FAO (MoALF, 2013) and lower than the global capita of 111.3 litres (IDF, 2016). Whilst Nakuru County is the second highest milk producer in Kenya (MoALF, 2015), low milk consumption rates have been reported among its populates. A survey done by smallholder dairy project in 2002 showed that the annual per capita consumption of milk in Nakuru urban and Nakuru rural was 55.2 and 50.4 litres respectively (Muriuki, 2011). Another exploratory survey done in Rift Valley Province, Kenya in 2010 revealed that the amount of milk given to the children increased with increased production. This was consistent with children in the age groups 12-18 and 18-24 months from the emerging and advanced groups that produced less than six litres and more than six litres a day respectively. However, children aged 6-12 months from the no milk production group in the same study consumed more milk than the other groups (Shreenath *et al.,* 2011). The study findings allude to the fact that milk availability does not necessarily translate into consumption.

Results from consumption of foods from different food groups only provide data with regards to whether milk was consumed or not consumed by children in past 24 hours. However this findings don't provide evidence of actual amount of milk consumed versus the recommended intake. It is also uncertain whether coming from DHs or NDHs, peri-urban or rural areas influences milk consumption patterns of children. The purpose of present study was to investigate the milk consumption patterns of children (24-59 months) from (DHs) and (NDHs) in both peri-urban and rural areas. This includes quantifying amounts fed to children and comparing them with the minimum recommended intakes. The present study was embedded in the Reducing Losses Adding Value (RELOAD) project which aims at securing global nutrition by increasing agricultural production (RELOAD, 2012).

METHODOLOGY

Study site

The study was conducted in Olenguruone (rural area) and Bahati (peri-urban area) divisions of Nakuru County in the South Rift Valley region in Kenya. Olenguruone is located in Kuresoi South, Sub-county of Nakuru County, lies at an altitude of 2100-2500 metres above sea level and receives a mean annual rainfall of 1200mm. Bahati is located in Nakuru North sub-county and lies at an altitude of 1700-2500 metres above sea level with annual rainfall ranging between 800-1600mm.

Study design

A cross-sectional study design was used where a total of 216 randomly selected DHs (n=108) and NDHs (n=108) were included. Multi-stage cluster sampling was applied in selecting the sample. In the first sampling stage Olenguruone and Bahati (former divisions) were purposively selected because they are regions with high milk production in Nakuru County. In the second sampling stage, a total of 7 locations that were involved in high milk production were also purposively selected from Olenguruone (n=5) and Bahati (n=2). In the

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third sampling stage, a listing of all smallholder farmers' households was obtained from the respective extension officers of Olenguruone and Bahati and used to generate the sampling frames. Olenguruone had 3000 DHs and 1384 NDHs while Bahati area had 2392 DHs and 2856 NDHs (MoALF, 2017). The smallholder DHS and NDHs with at least one child aged 24-59 months and their primary caregivers were randomly selected proportionate to population size from Olenguruone (61 DHS and 36 NDHs) and Bahati (47 DHs and 72 NDHs) areas.

Data collection

Data was collected by the researcher and an assistant who were conversant in English and Kiswahili the standard and national languages in Kenya respectively. Pre-tested semi-structured questionnaires developed in English and translated to Kiswahili were used to collect data through face to face interviews with the primary caregivers in their homes. The study was carried out from February to March 2018 in both peri-urban and rural areas.

Socio-demographic characteristics: The primary caregivers were asked to give information on the number of members that permanently resided in the households, number of cows each household had, their age in years, education level, occupation, children's age in months and sex. Ages of children were verified by examining the children's health cards/birth certificates/baptismal certificates provided by the primary caregivers. In cases where these documents were not available seasonal calendars were used and the primary caregivers engaged in a recall to determine the season or event of year when the child was born (Cogill, 2003). Children ages were recorded in months and before the household interviews were conducted the researchers confirmed that the children were within the target age limits (24-59 months).

Dietary intakes: The qualitative interactive 24 hour dietary recall method was used to assess the dietary intake of the children (Gibson and Ferguson, 2008). The primary caregivers who are responsible for food preparation were asked by the researcher to recall all the foods and drinks that the children had consumed the previous day. All the foods and drinks, and where possible ingredients of all foods and drinks that the children had eaten or drank 24 hours prior to the survey were recorded.

Data generated from the 24 hour dietary recall was used to assess dietary diversity (DD) of the children (WHO, 2010). DD is defined as the consumption of a variety of foods over a given period of time and is usually used as a proxy for nutrient adequacy in an individual's diet (Kennedy *et al.,* 2011). Children's dietary diversity score (CDDS) was calculated based on seven food groups recommended by WHO for children aged 6-23 months (WHO, 2008; WHO, 2010). Children who consume foods from at least four or more food groups out of seven are considered to have received minimum dietary diversity (MDD) (WHO, 2008; WHO, 2010). In this study, DD of children (24-59 months) was based on the current WHO guidelines for 6-23 months old children due to absence of guidelines for children of other age groups.

Frequency of consumption of milk and milk products: a food frequency questionnaire (FFQ) was used to collect data on the frequency of consumption of milk and other milk products by the children (24-59 months) over the past seven days. The forms in which milk was

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consumed were categorized as fresh milk, milk tea, milk with cereal, vegetables cooked with milk and other milk products (Sadler *et al.,* 2012). The primary caregivers were requested to provide the cups that the children normally used to consume fresh milk and water was used to estimate the amount of milk consumed at each feed using a 500ml measuring jug. The data on amounts of milk consumed was used to determine whether the quantities taken by children met 50% or more of the recommended nutrient intakes (RNIs) (Sadler *et al.,* 2009). For other forms of milk consumed the frequency were determined as the total number of intakes per day.

Ethical considerations: Research permit and ethical approval to conduct the study was obtained from the Egerton University's Research Ethics Review Committee and the National Commission for Science, Technology and Innovation (NACOSTI), Nairobi, Kenya. Both verbal and written consent were sought from the study participants prior to data collection.

Data management and analysis

The data collected was cleaned, coded and entered into the Statistical Package for Social Sciences (SPSS) computer software version 20 for analysis. Descriptive analyses were performed to provide background characteristics of the study population. Means ±SD and frequencies were computed for the socio-demographic data, children's dietary diversity and milk consumption patterns. Continuous variables such as age, household size were presented as means ±SD while categorical variables as percentages. These characteristics were further compared for statistical differences between the DHs and NDHs in peri-urban and rural areas using the Chi-square tests for categorical data and T-tests for continuous data with a significance level of α=0.05. Multilinear regression tests were performed to test the relationship between socio-demographic characteristics, child dietary diversity and milk consumption of children at α=0.05 level of significance.

Results

A total of 216 primary caregivers with children aged 24-59 months were interviewed from both the smallholder DHs (n=108) and NDHs (n=108) from rural/ peri-urban area. All of the primary caregivers in both peri-urban and rural areas were female. These were either the index child's biological mother, grandmother, elder sibling or aunt.

Sociodemographic and economic activities characteristics

The socio-demographic characteristics of the study population are presented in Table 1. The ages of the caregivers ranged from 25-40 years with a mean age of 32.1 ± 10.0 and 26.7 ± 10.2 years among those from DHs and NDHs respectively. There was significant differences (*P*=0.000) between age groups in DHs and NDHs in peri-urban area while no significant differences were noted between age groups in DHs and NDHs in the rural area of the study.

To note is that primary caregivers in DHs (8.5% *vs* 13.1%) attained a higher education level than their counterparts in NDHs (1.4% vs 8.3%) in both the peri-urban and rural areas. In the peri-urban area 2.1% of the primary caregivers from DHs and 4.2% from NDHs were reported to have no form of education. Additionally, in the rural area 4.9% of the primary caregivers from DHs also had no form of education while 2.8% of those from NDHs had at least preschool education. There was a significant difference (*P*=0.041) in the education

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levels between caregivers from the DHs and NDHs in peri-urban area. The main occupation of the primary caregivers from DHs (61.8%) and NDHs (52.8%) in both peri-urban and rural (70.5% in DHs *vs* 72.2% in NDHs) areas was farming. This was followed by unemployment where by 10.6% (DHs) and 26.4% (NDHs) of the primary caregivers in peri-urban while in the rural area 9.8% (DHs) and 8.3% (NDHs) of the caregivers were unemployed. There was a significant difference (*P*=0.023) among occupation types in DHs and NDHs in the peri-urban area and no significant difference (*P*=0.588) was exhibited in the rural area.

Average age of the children in the study was 41.0 ± 10.5 months in DHs and 39.5 ± 9.6 months in NDHs. Most of the children (63.8%) from the peri-urban area were female while the opposite was true in the rural area. The mean household size was 5.5 ± 1.8 members in DHs while in the NDHs the mean was 4.9 ± 1.7 members. There was a significance difference (0.011) in the mean household sizes between DHs and NDHs.

Consumption of foods from different food groups by children (24-59 months)

All children (n=216) from the smallholder DHs and NDHs in both rural and peri-urban areas consumed grains, roots and tubers, Table 2. Further most of the children in the study consumed vitamin A rich fruits and vegetables and other fruits & vegetables. Children from DHs (80.3%) and NDHs (72.2%) in the rural area consumed more milk compared to those in peri-urban (57.4% in DHs *vs* 40.3% in NDHs). Consumption of flesh foods and eggs was low in all households in both peri-urban and rural area. There was a significant difference (*P*=0.043) in the consumption of eggs among the DHs and NDHs in peri-urban area (Table 2). The mean CDDS of children from DHs was 4.1±1.1 and 4.1± 0.9 food groups from NDHs (Table 2).

Milk production among DHs and NDHs

Smallholder farmers from DHs in peri-urban area had a mean of 1.4 ±0.6 cows while those from rural had a mean of 1.8 ± 0.9 cows (Table 3). Majority of the DHS in peri-urban (76.1%) and rural (86.9%) produced 1-10 litres of milk in a day. Besides DHs producing milk 4.3% of them from the peri-urban area purchased milk. On the other hand, 97.2% of NDHS in peri-urban and rural areas purchased milk. This milk was mostly purchased from local farmers (50.0% DHs vs 65.0% NDHs) in peri-urban and (86.1% NDHs) rural areas. There was a significant difference (0.000) between households that purchased milk in both peri-urban and rural areas but no significant difference (0.965) in the source of milk (Table 3).

Milk consumption of children (24-59 months) from DHs and NDHs.

Milk consumption patterns of children were assessed by examining the milk intakes i.e. the amounts taken and frequencies of consumption. Only 13.1% of the children from DHs and 5.6% from NDHs in rural area consumed a minimum milk intake of 500mls while none of the children from peri-urban area had consumed the minimum 500mls of milk in the past 24 hours. The proportion of children who met 50% or more RNIs from consuming at least 500mls of milk were 13.1% (DHs) and 5.6% (NDHs). The mean milk intake of the children (in millimeters) was 285.5±214.6 in DHs and 222.3±90.6 in NDHs while in peri-urban and rural areas the mean intake was 215.7±8.6 and 292.4 ± 216.6 respectively (Table 4). There

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was significant differences in the mean intakes of milk by children i.e. 0.001 (peri-urban vs rural) and 0.005 (DHs vs NDHs).

Further analyses were performed to determine amounts of milk consumed by children disaggregated by age categories groups (24-36, 37-48, 49-59 months). The findings showed that a higher proportion of younger children (24-36 months) consumed milk compared to children from other age groups in both DHs and NDHs, peri-urban and rural areas (Table 4). There was a significant difference in milk intakes among the children age groups in DHs (P=0.036) and NDHs (P=0.007). Similarly, there was also a significant difference in milk intakes among the children age groups in peri-urban (P=0.036) and rural areas (P=0.002).

Frequency of consumption of foods and fluids containing milk among children (24-59 months) from DHs and NDHs.

More children from both DHs and NDHs in rural and peri-urban areas were reported to have consumed fresh cow's milk at least once the previous day (Table 5). There was a significant (P=0.039) difference in the frequency of milk intakes among the children from DHs and NDHs in peri-urban but no significant difference in the rural area. Other forms of milk consumed in the previous day are shown in Table 5. Findings from this study indicated that tea with milk was commonly consumed by children aged 24-59 months in DHs and NDHs in both peri-urban and rural areas. Porridge cooked with milk was rarely fed to the children, with only 8.2% and 5.6% of children in DHs and NDHs from the rural area, consuming it once the previous day respectively. In the peri-urban area 2.1% and 2.8% of the children from DHs and NDHs respectively were given porridge cooked with milk thrice the previous day. *Ugali* was the main cereal consumed with milk in this study. The *Ugali* was fed up to three times the previous day among children in the rural area and more than three times among those children in the peri-urban area in both DHs and NDHs. There was a significant difference (P=0.001) in children's consumption of cereals with milk in the peri-urban area among DHs and NDHs. Vegetables cooked with milk were only consumed by children from rural area in both DHs and NDHs.

Frequency of milk products consumed by children over a week

While *Mursik,* yoghurt and sour milk were not consumed by children from DHs and NDHs from rural and peri-urban areas the previous day, they were reported to have been consumed by the children at least one or more times during the previous week. Yoghurt and sour milk were commonly consumed by children from DHs and NDHs in the peri-urban area while *Mursik* was mainly consumed by children from DHs and NDHs from the rural areas. Yoghurt and sour milk were purchased ready made from the shops while *Mursik* was locally made in the households by women. More children from NDHs consumed the *Mursik i.e.* over three times in the past week as compared to those from DHs. Equally yoghurt was mostly consumed by children from NDHs while sour milk by children from DHs (Figure 1).

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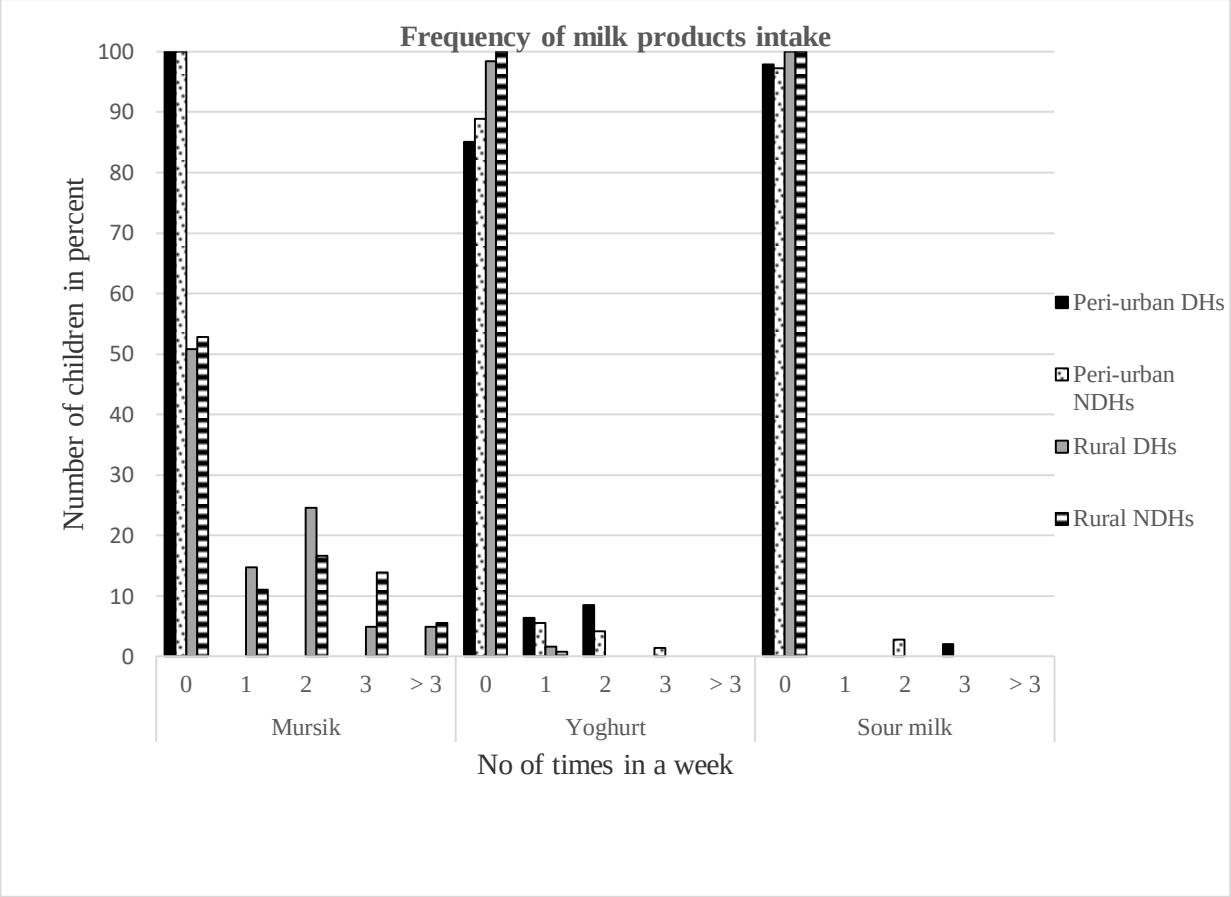

Figure 1: Frequency of consumption of milk products by children (24-59 months)

Associations between socio-demographic characteristics, child dietary diversity and milk consumption of children.

Further analysis was done to determine whether there were any significant associations among the above mentioned factors. Multiple linear regression test was done and the model showed that caregivers' age, occupation, education level, children's sex, age, dairy cow ownership, CDDs and location contributed to 18.4% of the amount of milk consumed by children (Table 6). The linear regression model was significant (P=0.001) at a level of α=0.005 in predicting the daily milk intakes by children (Table 7). Out of all predictor variables dairy cow ownership was a significant (0.019) predictor of child milk intake in a day (Table 8).

DISCUSSION

The study aimed at determining the milk consumption patterns of the children aged 24-59 months from both DHs and NDHs in peri-urban and rural areas in Nakuru County. The key focus was finding out the consumption rate of milk by children, their amounts and whether

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the amounts taken met the minimum recommended. Their diets were also assessed to determine whether they were diverse and their contribution to milk consumption. Findings showed that the mean CDDS of the children from both DHs and NDHs in peri-urban and rural areas was four out of the recommended seven food groups, indicating that most of the children had received MDDs. However when a comparison was done among the CDDS it was discovered that a higher proportion of children from DHs in both peri-urban and rural areas did not receive a MDD (i.e. consumed 3 food groups) compared to those from NDHs. Other studies reported contrary results where children were fed on low quality diets that were not diverse and did not attain the MDD. For instance, the KDHS findings showed that only 41% of the children (6-23 months) in Kenya were fed on diets that met the MDD (KNBS and ICF, 2015). Other developing countries similarly fed their children on diets that didn't met the MDD requirements. For instance, only 7% of children in Ethiopia and less than a quarter of the children in India, Uganda and Zimbabwe met the recommended MDD (Jones *et al.,* 2014). Another study conducted in Afghanistan, Bangladesh, India, Nepal and Pakistan indicated that only 25% of the children aged 6-23 months were fed on diets that met the MDD (Aguayo and Menon, 2016). The findings show that dietary diversity is still a challenge in developing countries including Kenya. Despite the current study indicating that children consumed diverse diets, the children who didn't attain MDD especially in the DHs can't be ignored. Therefore there is need to sensitize the smallholder farmers on appropriate child feeding practices such as food diversification. This can be achieved through direct consumption of foods from their farms, produce from livestock or from purchase of nutrient dense foods.

Narrowing down to consumption of individual food groups it was discovered that diets of children from both DHs and NDHs; peri-urban and rural areas were based mainly on the plant food sources. This finding agrees with those from other studies which indicated that children were mainly fed on plant based diets (Nicholson *et al.,* 2003; Neumann *et al.,* 2007; Walton *et al.,* 2012; Dewey, 2013; Waswa *et al.,* 2015). Jin and Iannoti (2014) further stated that children's diets are also deficient in ASFs and true to this statement very few children from both DHs and NDHs in this study consumed eggs and flesh foods. On the other hand the study revealed that a high proportion of children consumed milk. Contrary to these results milk consumption by children below five years has been on the decline in developed countries (Dror and Allen, 2014). The 2014 KDHS also indicated that only 13% of Kenyan children aged 6-23 months consumed milk and milk products. Comparisons between DHs and NDHs indicated that more children from DHs consumed milk than those in NDHs. A study in Kenya by Shreenath *et al.,* (2011) reported similar findings where children (18-24 months) from an advanced milk production group consumed more milk than children from other groups (emerging group, no milk group). However, findings from the same Kenyan study showed higher milk intake for children (6-12 months) from the no milk production group (Shreenath *et al.,* 2011). Findings from the present study allude to the fact that milk availability in a household translates to consumption especially by the children however this doesn't necessarily mean that the amounts are adequate or they met the minimum recommended intakes. Thus this calls for creation of awareness to smallholder farmers to ensure that milk secluded for household consumption meets the demands of children and other family members.

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The commonly consumed form of milk by the children was tea, followed by plain fresh milk while a few others consumed milk added into porridge, yoghurt and *Ugali* with milk. Vegetables cooked in milk and traditional fermented milk '*Mursik*' were mainly consumed in the rural area while sour milk consumed mainly in peri-urban. Further analysis to determine the actual amounts of milk consumed by children from DHs and NDHs in both peri-urban and rural areas indicated a low intake (<500 mls) by many children. Very few children from DHs and NDHs in rural area had consumed the minimum recommended milk intake of 500 mls while none of the children from peri-urban area had met this minimum requirement. This was despite the fact that milk was evidently available through own production in DHs or purchase in the NDHs. In addition more children in rural area consumed milk compared to those in peri-urban area while more children within the young age category consumed milk compared to the older children. This was evident in DHs and NDHs, rural and peri-urban areas.

Analysis was done to determine the association between socio-demographic characteristics and milk consumption patterns of children from DHs and NDHs in rural/ peri-urban areas. The multi-linear regression analysis revealed that there was a positive and statistical significant relationship between socio-demographic, CDDs and milk intake by children. This linear model indicated that having a dairy cow increases the daily milk intake by children. Findings from the present study conquer with findings from other studies by Hoddinott *et al.* (2014) and Rawlins *et al.* (2014) which revealed that livestock ownership directly or indirectly influenced milk consumption by children. As a source of ASFs livestock provides essential nutrients required for child growth and development. The sale of animal products equally provides income that could also be used to purchase food (Jin and Iannotti, 2014; Rawlins *et al.,* 2014).

Research Implications

The study revealed that milk was available in all households (DHs/ NDHs) despite the children consuming amounts that were below the minimum recommended of 500mls, the caregivers' level of education was low (mostly primary level) besides some of them not being educated and children's diets were mainly plant based with few consuming ASFs. This calls for nutrition education interventions to sensitize communities on appropriate child feeding practices and harness behavior change among them. Interventions should target educating communities on diet diversification with emphasis on consumption of ASFs and inform them on practices that lower bioavailability of nutrients.

CONCLUSION

This study findings indicate a higher prevalence of consumption of milk by children compared to the national level or other developing countries. However, the actual amounts of milk consumed were found to be below the minimum recommended. These low intakes of milk can negatively impact the nutrition of children, their health and overall development. Thus, there is need for nutrition education interventions among the smallholder farmers to sensitize them on importance of milk consumptions and encourage its consumption. Further the findings indicated that milk was accessible to all (DHs and NDHs) therefore its

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consumption should be promoted to ensure that children take the required amounts that would contribute to them meeting their nutrient requirements for proper growth and development. Primary caregivers should be targeted as they are directly involved in the feeding of children. Grandmothers and husbands influence feeding practices of children besides providing supportive environments that would enable behavior change among caregivers hence they should be targeted in the education interventions as well. In some cases the grandmothers and husbands are also primary caregivers hence including them will enable them make informed choices during feeding especially regarding milk consumption. Interventions and follow up studies are required to monitor and evaluate the consumption of milk and other ASFs.

Future Research

The present study evidently indicates that children below five years did not consume milk in the required amounts but since this was a cross sectional study it wasn't established whether seasons (wet/dry) would have influenced the milk consumption patterns. Therefore longitudinal studies should be carried out to establish the amounts of milk consumed by children at the different seasons. Further experimental designs should also be implored in other researches to establish the direct contribution of milk to diets of children and their overall health outcomes.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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APPENDIX

Table 1: Socio-demographic characteristics of DHs and NDHs in Peri-urban and Rural areas, Nakuru County

Characteristics	DHs (n= 108)		NDHs (n=108)		
	Mean	SD	Mean	SD	*P*┼
Household size	5.5	1.8	4.9	1.7	0.011*
Children's age	41.0	10.5	39.5	9.6	0.272
Caregivers' age	32.1	10.0	26.7	10.2	0.000*

Responses in percent

	Peri-urban				Rural			
	DHs (n= 47)	NDHs (n= 72)	Total (n= 119)	*P*╪	DHs (n= 61)	NDHs (n= 36)	Total (n= 97)	*P*╪
Children's sex								
Male	36.2	44.4	41.2	0.370	62.3	58.3	60.8	0.699
Female	63.8	55.6	58.8		37.7	41.7	39.2	
Caregivers								
Age								
18-24	8.5	31.9	22.7	0.001*	21.3	38.9	27.8	0.114
25-40	85.1	55.6	67.2		63.9	58.3	61.9	
41-55	6.4	2.8	4.2		4.9	0.0	3.1	
> 55	0.0	9.7	5.9		9.8	2.8	7.2	
Education level								
No education	2.1	4.2	3.4	0.041*	4.9	0.0	3.1	0.051
Preschool	0.0	1.4	0.8		0.0	2.8	1.0	
Primary	42.6	65.3	56.3		37.7	63.9	47.4	
Secondary	46.8	27.8	35.3		44.3	25.0	37.1	
Tertiary	8.5	1.4	4.2		13.1	8.3	11.3	
Occupation								
Unemployed	10.6	26.4	20.2	0.023*	9.8	8.3	9.3	0.588
Salaried employment	10.6	0.0	4.2		11.5	5.6	9.3	
Casual	2.1	6.9	5.0		0.0	2.8	1.0	
Farmer	61.7	52.8	56.3		70.5	72.2	71.1	
Retired	4.3	2.8	3.4		0.0	0.0	0.0	
Business	10.6	11.1	10.9		8.2	11.1	9.3	

DHs- Dairy households, NDHs- Non-dairy households, SD- standard deviation, *P*╪ *value* derived from χ^2test, *P*┼ value derived from t test

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Table 2: Consumption of different food groups by children (24-59 months) in, Nakuru County.

Characteristics	Responses in percentage							
	Peri-urban				**Rural**			
Food groups	DHs (n=47)	NDHs (n=72)	Total (n=119)	*P*ǂ	DHs (n=61)	NDHs (n=36)	Total (n=97)	*P*ǂ
Grains, roots and tubers	100.0	100.0	100.0	-	100.0	100.0	100.0	-
Legumes and nuts	44.7	59.7	53.8	0.108	49.2	38.9	45.4	0.325
Flesh foods	19.1	18.1	18.5	0.881	9.8	11.1	10.3	0.842
Eggs	19.1	6.9	11.8	0.043*	3.3	2.8	3.1	0.891
Dairy products	57.4	40.3	47.1	0.067	80.3	72.2	77.3	0.357
Vitamin-A rich fruits & vegetables	76.6	86.1	82.4	0.183	75.4	83.3	78.4	0.360
Other fruits & vegetables	95.7	100.0	98.3	0.078	91.8	94.4	92.8	0.627
	Mean	SD			Mean	SD	*P*┼	
	Peri-urban				Rural			
CDDS per area	4.1	1.0			4.1	1.0	0.791	
	DHs				NDHs			
CDDS per HHs	4.1	1.1			4.1	0.9	0.779	

DHs- Dairy households, NDHs- Non-dairy households, *P*ǂ *value* derived from χ^2 test, *P*┼ value derived from t test

CDDS- Child dietary diversity score

Table 3: Comparison in milk production between DHs and NDHs in Peri-urban and Rural areas

	Percentage of respondents				
Characteristics	**Peri-urban**		**Rural**		
	Mean	SD	Mean	SD	*P*┼
Cows	1.4	0.6	1.8	0.9	0.007*

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Daily milk production in litres								
	DHs (n=47)	NDHs (n=0)	Total (n=47)		DHs (n=61)	NDHs (n=0)	Total (n=61)	
0	6.5	-	6.5		-	-	-	
1-10	76.1	-	76.1		86.9	-	86.9	
11-20	15.2	-	15.2		8.2	-	8.2	
21-30	2.2	-	2.2		4.9	-	4.9	
Milk purchase								
	DHs (n=47)	NDHs (n=72)	Total (n=119)	*P*ǂ	DHs (n=61)	NDHs (n=36)	Total (n=97)	*P*ǂ
Yes	4.3	97.2	60.5	0.000*	0.0	97.2	36.1	0.000*
Milk source								
	DHs (n=2)	NDHs (n=72)	Total (n=74)	*P*ǂ	DHs (n=0)	NDHs (n=36)	Total (n=36)	
Local farmers	50.0	62.5	62.2	0.965	-	86.1	11.1	
Family	0.0	1.4	1.4		-	11.1	11.1	
Shops	50.0	27.8	28.4		-	2.8	2.8	
Dairy cooperatives	0.0	6.9	6.8		-	-	-	
Not purchased	0.0	1.4	1.4		-	-	-	

DHs- Dairy households, NDHs- Non-dairy households, SD- standard deviation, *P*ǂ *value* derived from χ^2test, *P*┼ value derived from t test

Table 4: Milk consumption by children (24-59 months)

Characteristics	**Peri-urban**				**Rural**			
	Mean	SD			Mean	SD	*P*┼	
Children milk intake in mls	215.7	85.6			292.4	216.6	0.006*	
	NDHs				DHs			
	222.3	90.6			285.5	214.6	0.023*	
	Responses in percent							
	0 mls	< 500 mls	≥ 500 mls	*P*ǂ	0 mls	< 500 mls	≥ 500 mls	*P*ǂ
Age in months	Child milk intakes in DHs n= 108				Child milk intakes in NDHs n=108			
24-36	8.3	22.2	6.5	0.036*	13.9	29.6	1.9	0.007*
37-48	12.0	21.3	0.9		22.2	16.7	0.0	
49-59	10.2	18.5	0.0		12.0	3.7	0.0	
	Child milk intakes in Peri-urban n= 119				Child milk intakes in rural n= 97			
24-36	15.1	24.4	-	0.036*	6.2	27.8	9.3	0.002*
37-48	26.1	14.3	-		6.2	24.7	1.0	
49-59	10.9	9.2	-		11.3	13.4	0.0	
	DHs (n=	NDHs (n= 72)	Total (n=	*P*ǂ	DHs (n=	NDHs (n= 36)	Total (n= 97)	*P*ǂ

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	47)		119)		61)			
0	42.6	58.3	52.1	0.092	21.3	27.8	23.7	0.072
< 500	57.4	41.7	47.9		65.6	72.2	68.0	
≥ 500	_	_	_		13.1	5.6	10.3	
RNIs	_	_	_		13.1	5.6	10.3	0.237

DHs- Dairy households, NDHs- Non-dairy households, SD- standard deviation, *P╪ value* derived from χ^2test, *P*┼ value derived from t test

RNIs- denotes the proportion of children who met 50% or more RNIs from consuming at least 500mls of milk.

Table 5: Frequency of foods and fluids with milk consumed by children (24-59 months) in a day

		Frequency intake by children in percent							
Food/ fluid	**No of times**	**Peri-urban**				**Rural**			
		DHs n= 47	NDHs n= 72	Total n= 119	*P╪*	DHs n= 61	NDHs n= 36	Total n= 97	*P╪*
Fresh milk	0	42.6	58.3	52.1	0.039*	21.3	27.8	23.7	0.683
	1	51.1	41.7	45.4		54.1	55.6	54.6	
	2	6.4	0.0	2.5		19.7	16.7	18.6	
	3	-	-	-		3.3	0.0	2.1	
	>3	-	-	-		1.6	0.0	1.0	
Milk tea	0	17.0	0.0	10.1	0.061	4.9	5.6	3.1	0.437
	1	23.4	38.9	32.8		19.7	22.2	20.6	
	2	42.6	40.3	41.2		49.2	38.9	45.4	
	3	12.8	15.3	14.3		21.3	36.1	26.8	
	>3	4.3	0.0	1.7		4.9	2.8	4.1	
Porridge	0	80.9	86.1	84.1	0.830	91.8	94.4	92.8	0.627
	1	14.9	9.7	11.8		8.2	5.6	7.2	
	2	2.1	2.8	2.5		-	-	-	
	3	2.1	1.4	1.7		-	-	-	
	>3	-	-	-		-	-	-	
Cereals	0	57.4	51.4	53.8	0.001*	27.9	25.0	26.8	0.940
	1	19.1	44.4	34.5		49.2	52.8	50.5	
	2	19.1	1.4	8.4		18.0	19.4	18.6	
	3	2.1	2.8	2.5		4.9	2.8	4.1	
	>3	2.1	0.0	0.8		-	-	-	
Vegetables	0	100.0	100.0	100.0		90.2	94.4	91.8	0.652
	1	-	-	-		8.2	5.6	7.2	
	2	-	-	-		1.6	0.0	1.0	
	3	-	-	-		-	-	-	
	>3	-	-	-		-	-	-	

DHs- Dairy households, NDHS- Non-dairy households, *P╪ value* derived from χ^2 test

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Tale 6: Model Summary[b] showing the relationship between socio-economic, demographic characteristics, child dietary diversity and milk consumption of children.

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.429[a]	.184	.131	163.588

a. Predictors: (Constant), children's age, location of study, caregivers' level of education, Caregivers' main occupation, caregivers' age CDDS, children's sex, dairy cow ownership.

b. Dependent variable: child milk intake in a day in mls

Table 7: Anova[a] results indicating the significance of the child milk intake model

Model	Sum of squares	df	Mean Square	F	Sig
1 Regression	742273.215	8	92784.152	3.467	0.001[b]
Residual	3291588.381	123	26760.881		
Total	4033861.597	131			

a. Dependent variable: child milk intake in a day in mls

b. Predictors: (Constant), children's age, location of study, caregivers' level of education, caregivers' main occupation, caregivers' age CDDS, children's sex, dairy cow ownership.

Table 8: Coefficients[a] results indicating the predictors of child milk intake

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
1	B	Std. Error	Beta		
(Constant)	634.942	130.659		4.860	0.000*
Location of study	-45.894	30.422	-.130	-1.509	.134
Caregivers' age	10.974	22.174	.042	.495	.622
Caregivers' level of education	-32.164	20.175	-.135	-1.594	.113
Caregivers' main occupation	-6.141	9.456	-.055	-.649	.517
Dairy Cow ownership	75.766	31.770	.214	2.385	.019*
CDDS	-45.985	42.877	-.090	-1.072	.286
Children's Sex	-47.301	30.208	-.135	-1.566	.120
Children's age	-66.127	19.692	-.288	-3.358	.001

a. Dependent variable: child milk intake in a day in mls

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