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NUTRITIONAL STATUS OF ADOLESCENT OFFENDERS IN ACCRA

BY

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DECLARATION

I, Richard Stephen Ansong, author of this dissertation do hereby declare that, the work presented here is a result of my own work carried out in the Department of Nutrition and Food Science, University of Ghana, Legon, under the supervision of Prof. Matilda Steiner Aseidu and Dr. Seth Adu-Afarwuah. References cited in this work, have been fully acknowledged.

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ABSTRACT

Background:

Adolescent offenders in juvenile detention centers are generally dependent on the centers for their nutrient intakes, and therefore their food selection may be limited, which could have a negative consequences for their nutritional status. We examined the nutritional status of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra

Methods:

The study was cross-sectional involving inmates (N= 79) between 13-19 years recruited from the Senior Boys Correctional Centre (SBCC) (n= 69), Junior Girls Correctional Centre (JGCC) (n= 6) and Boys Remand Home (BRH) (n=4) in Accra. A pretested questionnaire was used to collect information on background characteristics, physical activity and dietary patterns. A daily weighed food intake was used to estimate the amounts of food consumed. A food composition table (FCT) and laboratory proximate analysis (LPA) of samples of food consumed (by means of standard analytical methods) were used to estimate their nutrient intakes. Clinical signs were assessed by observation. Inmates' weight and height were measured, and their sex-adjusted BMI-for-age z-scores (BMIZ) were calculated using WHO (2007) reference values for children 10-19 years of age. Using a univariate analysis (Pearson's correlation), selected variables found to be correlated with low BMIZ (BMIZ < -1 SD) were used in a multiple logistic regression analysis to determine which of the variables were significantly associated with low BMIZ.

Results:

A vast majority (92.4%) of whom were males. Mean age of the inmates was 16.6 ± 1.5 years, mean number of months spent at the center was 9.1 ± 7.4 months, and almost (98.7%) all of the participants were first-time offenders. Weeding as a physical activity was performed by more

inmates than any other physical activity and was followed by sweeping and soccer. About 74% of the inmates spent between 30 min and 1 hour performing this activity. Inmates reportedly had good appetite but were sometimes or often hungry. There were stark differences in the nutrient intakes values obtained using FCT versus LPA. Regardless of the method (FCT versus LPA) used, carbohydrate contributed immensely to their total energy intake. Based on intakes using FCT, the mean adequacy ratio, MAR (average ratio of nutrient intake to the recommended intake (each truncated at 1) of calories and six nutrients was 75.6 % (JGCC=75%, BRH= 82.1%, SBCC= 69.9%). However, the MAR calculated using the LPA showed inadequacy in their nutrient intake was 27.5% (JGCC= 26.1%, BRH= 28.8%). About 18% of the inmates had a low BMIZ. Pale conjuctiva was the most predominant clinical sign observed suggestive of severe anaemia. Even though sex , age , being in the JGCC , being in the SBCC, illness in the month preceding the interview, and the average numbers of time they ate per day were significantly correlated with low BMIZ and were included in the multiple logistics regression, only age was a significant predictor of low BMIZ (OR= 10.12; 95% CI=1.57, 25.11, p= 0.042)

Conclusion:

The nutrient intakes of adolescent offenders at the three juvenile detention facilities appeared adequate on average when determined using FCT but inadequate when using LPA. Majority of the inmates engaged in physical activity. Nearly 1 in 5 inmates (18%) had a low BMIZ and paleness of the conjuctiva of the eye suggesting severe anaemia was common. There is the need for intervention programs to improve the nutritional status of institutionalized adolescent offenders in Ghana.

DEDICATION

This thesis is dedicated to the almighty God who has been with me throughout these years and given me strength to complete this work successfully. I also dedicate this book to my parents Mr. and Mrs. Twumasi - Ankra Bonsu, my siblings and all institutionalized adolescent offenders.

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LIST OF ABBREVIATIONS

ACHPR	African Commission of Human and People's Rights
AIDS	Acquired Immune Deficiency Syndrome
AOAC	Association of Analytical Communities
BMI	Body Mass Index
BMIZ	BMI-for-age zscore
BRH	Boys Remand Home
CDC	Centre for Disease Control and Prevention
CDPH	California Department of Public Health
DNA	Deoxyribonucleic acid
FAO	Food and Agriculture Organization
FCT	Food Composition Table
GPS	Ghana Prison Service
HAZ	Height to Age z-score
HIV	Human Immunodeficiency Virus
ICPS	International Centre for Prison Studies
ICESCR	International Covenant on Economic, Social and Cultural Rights
IRB	Internal Review Board
JGCC	Junior Girls Correctional Centre
MAR	Mean Adequacy Ratio
NAR	Nutrient Adequacy Ratio
NHANES	National Health and Nutrition Examination Survey

OR	Odds Ratio
RDA	Recommended Daily Allowance
LPA	Laboratory Proximate Analysis
SBCC	Senior Boys Correctional Centre
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nations Children's Fund
UNODC	United Nations Office on Drugs and Crime
USD	United States Dollar
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

Adolescence is one of the critical periods of change throughout the lifetime of an individual (Hoelsher *et al*. 2002). Jenkins and Horner (2005) and California Department of Public Health (CDPH) (2013) also defined adolescence as a dynamic period of development marked by rapid changes in growth and development with emotional, psychological and biological changes which results in an increase in nutritional demand. It is a transition from childhood through to adulthood, and adolescents make lifestyle choices that affect both their current and future health as well as establish patterns of behavior (Centre for Disease Control and Prevention (CDC, 2012). Not only changes in the body shape occur but independent cognitive processes as well as a transition of social values and roles of adults also begins. Work conducted by Story and Stang (2005) suggests that adolescence is the only time after infancy where there is an increase in physical growth. About 20% of the ultimate adult height and 50% of the ultimate weight is contributed by the growth spurt in adolescence (WHO, 2006). In this period, adolescents vary food choices and may narrow or expand healthy options (CDPH, 2013).

During the period of adolescence, growth and development occur at different rates and it is sometimes difficult to accept a changing body (Kohl and Cook 2013). This is a period where they become adventurous, as stated by Mortimer *et al*. (2008) and Cicchetti (2006), and sometimes, in a bid to satisfy their adventurousness, may fall in conflict with the laws. If found culpable, the law allows appropriate punishment to be meted out to them backed by the Juvenile Justice Act, 2003 (Act 653) of Ghana which includes incarceration for a minimum of 3 months and a maximum

of 3 years, depending on the gravity of offence. For this reason, Ayete-Nyampong (2011) defined an adolescent offender as an adolescent whose behaviors are contrary to the laws of the land.

Under Act 653, adolescent offenders are expected to be treated differently from adults. This means that they will be kept in different facilities to reform them. Individuals living in the care of long-stay institutions, like the juvenile detention facilities, boarding houses and other similar establishments, may frequently face nutritional problems compared with non-institutionalized individuals. A study conducted by Akinyemi and Ibraheem, (2009) in a boarding school in Nigeria to determine the nutritional status of 40 students between the ages of 10 - 19 years revealed that students in that boarding school were mostly underweight with inadequate caloric intake particularly among students of younger ages. Another study by Luo *et al.* (2009), on malnutrition in Chinese boarding schools revealed that, inadequate nutrition intake among adolescent girls in senior high boarding schools may have served as an important cause of nutrient deficiencies especially low student height-for-age z-scores (HAZ), as students eating at the school had a much lower HAZ on average than that of non-boarding students.

People in institutional care mostly rely on their institution for their dietary intakes. As a result, their food selection may be restricted to what is provided by the caterer and the types of meals presented are frequently dictated by managerial and financial constraints.

1.1 RATIONALE

Adolescents were at the forefront of change leading to the unrest in the far north Africa and the Middle East which begun in Tunisia in December 2010 and in 2014 demonstrations on the streets of Hong Kong pushing for change. The health, nutritional status and general wellbeing of

adolescents can play a key role in nation building. A healthy and educated workforce has the potential to change the economic fortunes of a country hence the nutritional situation should not be taken for granted since they are the future of the world. Poverty, social unrest, unemployment, poor education and inadequate nutrition on the other hand, can destroy this potential and affect health. It was therefore not surprising that Pope Francis in a letter addressed to the Australian Prime Minister, President of the G20 summit to pay attention to the plight of the teaming youth including the adolescents who are suffering from severe malnutrition. It is important to heed to his call so as to avoid holding back global economic development in the near future. The Millennium Development Goals established in 2000 have spearheaded a universal health policy for more than a decade now. Adolescence has become a key focus as the advancement of adolescent health is key to the attainment of global targets linked to child mortality, maternal health and HIV/AIDS.

"Every person in Ghana, whatever his race, place of origin, political opinion, colour, religion, creed or gender shall be entitled to the fundamental human rights and freedoms of the individual" (The Constitution Of The Republic Of Ghana, 1992). Appropriate and adequate nutrition and good health are the right of all individuals and that also form the basis of development of a nation.

In the recent past, more attention has been focused on under nutrition among children 0 – 5 in Ghana. Again, several works have been done on adolescents in Ghana, however, the nutritional status of the adolescents at the correctional centres has received little attention. Nutrient needs are greatest during this period and are influenced by events of puberty and simultaneous growth spurt.

Understanding the true lifestyle and nutrition situation is key to planning appropriate intervention programmes for inmates. Findings from this research could support advocacy towards policy on nutrition for the adolescent in correctional centres as well as inform other researchers and organization including the Prison Service in planning programmes for similar groups elsewhere.

The right functioning of these institutional care facilities has a great impact on the development of the nation as the youth make up proximately 35% of the population of Ghana as estimated by the Ghana Statistical Service (2012). The youth are thus a rich store for human capital and their proper fostering coupled with good nutrition by care institutions will further enhance and sustain Ghana's developing economy. There is a strong association between nutrition and cognitive development which will further impact productivity (Black, 2003). Care should be taken since their stay in the correctional centre or remand home is not going to be permanent but will be reunited with society after they serve their sentence and hence all measures should be put in place in order to prevent relapse.

1.2 OBJECTIVES

1.2.1 Main objective

This study sought to assess the nutritional status of adolescent offenders at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

1.2.2 Specific objectives

i. To assess the physical activity level and duration of the activity of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

ii. To determine the dietary patterns and intakes of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

iii. To compare their dietary intakes using the laboratory proximate analysis (LPA) and the food composition table (FCT)

iv. To determine Body Mass Index (BMI) of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

v. To assess the clinical signs of nutritional deficiencies and blood pressure of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

vi. To determine the predictors of low BMI for age z-score of adolescent inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 **Nutrition and the adolescent child**

Adolescence is the period of life between the onset of puberty and adulthood (10-19yrs) (Choudhary, 2014). The phenomenal growth that takes place during this time increases the demand for energy along with nutrients. Overall nutrient needs according to Tiwari (2013) and Stang and Story (2005) are greater during adolescence compared to any other time in the lifecycle. Physical growth and Nutrition are related integrally with optimal nutrition being a requisite for achieving full growth potential. According to the American Medical Association (1992) guidelines for adolescent preventive services, inadequate dietary intake at this time can arrest or slow linear growth and may even result in delayed sexual maturation.

Nutrient requirement parallel growth rate, with the greatest nutrient needs taking place at the peak of their growth velocity. The nutritional demands may be twofold higher at the peak of the adolescent growth spurt (Forbes, 1992). For adolescents, protein-energy malnutrition, vitamin A, iodine, calcium and folate deficiencies are identified by WHO as crucial to address (WHO, 1999). Yet adolescents, living in developing countries, now suffer from and are at a high risk for developing chronic diseases previously linked only to affluence like cancer, osteoporosis and cardiovascular disease (Schneider, 2000). Therefore the nutrients needs in relation to their general health conditions need to be given the necessary attention in a holistic manner.

The foods adolescents eat are crucial to their health and nutritional status. The kind and amount of food make a difference in whether an individual will be well or poorly-nourished. The statement made in 1936 by Sir Robert McCarrison (a British army doctor in the 1920s and 1930s)

that, “the greatest single factor in the acquisition and maintenance of good health is perfectly constituted food” reveals the importance of food and nutrition in the maintenance of good health (Temple and Burkitt, 2012). There are no simple criteria to assess nutritional status, and the question about whether a person is well nourished cannot be answered with certainty. However by evaluating a variety of assessment parameters it is possible to assess the risk of nutritional problems and to formulate preventive or therapeutic interventions.

2.1.1 The life stage of adolescents

Puberty, the set of biological changes as described by Arnett (2012) involved in achieving sexual as well as physical maturity is universal, notwithstanding the fact that there will be differences in timing. Adolescence has more to it than being a processes of puberty but a period where the young person also prepares to take on roles and responsibilities of adulthood (Zarrett and Eccles, 2006). The first noticeable changes of puberty starts at adolescence and in the course of these changes the body transforms as stated by Body (2010) in many ways until they are biologically ready to reproduce sexually (Arnett,2012). At the end of their second decade of life adolescents look different compared to how they looked before puberty.

Alsaker and Flammer (2006) suggest that once a threshold level of body fat is achieved pubertal transformation starts. Shalatin and Philip (2003) as well as Jones and Lopez (2013) further explain that as the proportion of fat gradually increases especially during mid-childhood once a threshold level is reached, a series of chemical processes are triggered in the hypothalamus. These chemical processes cause the ovaries and the testes to increase their production of estrogen (estradiol) and androgen (testosterone) (Shirtcliff *et al*., 2009). Same levels of estradiol and testosterone are produced throughout childhood but once puberty begins, the hormonal levels

change drastically (Money, 1980). Susman and Rogol (2004) assert that estradiol production in female increase 8 times while in males it increases 2 times. On the other hand, testosterone levels in males increase 20 times while that in the female increase 4 times. Males relatively deposit more muscle while the female relatively deposit more fat. This increase in hormonal level is responsible for both the primary and secondary sexual characteristics. Nutritional requirements are sex dependent as seen in DRI tables due to difference in body composition (Wu and O'Sullivan, 2011).

2.1.2 Nutritional needs of adolescents

According to Story and Stang (2005), nutrient needs are greatest during this period. Rolfes *et al*., (2011) expands this concept by stating that nutrient needs rises throughout childhood, peaks in adolescence and finally levels off or diminishes as the adolescent grows into an adult. Sardesai, (2003) also adds that nutrient needs are influenced by events of puberty and simultaneous growth spurt.

Puberty, a physiological developmental stage in humans , is an intense anabolic period characterized by increase in height, increase in weight, alterations in body composition and enlargement of many organ systems (Sardesai, 2003). It is characterized by important psychological and social changes, not only physiological change (WHO, 2005).Growth spurt in adolescence contributes about 20% of the ultimate adult height and 50% of the ultimate adult weight (Krebs *et al*, 2007; Wardlaw and Smith, 2008). In the time of the growth spurt of adolescence, close to 37% of total bone mass may be accumulated (Key and Key, 1994). It is therefore not surprising that the peak nutritional requirements occurs during adolescent years.

The nutritional requirement of the adolescent includes energy, fat, protein carbohydrates, vitamins (vitamins A, E and folate) and minerals (magnesium, iron, calcium and zinc). Inadequate

intake of these nutrients will lead to deficiencies which will affect growth and development (Drake *et al*., 2002; Jukes *et al*., 2004). For the purpose of this study I will focus on energy, fat, protein carbohydrate, iron, zinc, and calcium which were the nutrients of interest.

Energy needs: The energy requirements of adolescents are determined by the basal metabolic rate, activity level and increased needs to support pubertal growth as well as development (Story and Stang, 2005; Sizer and Whitney, 2006). Energy requirements as total kilocalories per day are greatest during this stage than at any other time in life with the exclusion of pregnancy as well as lactation (Ross and McMahon, 2013). Adolescent males have a greater caloric demand since they experience greater increases in weight, height and lean body mass compared to females (Story, 1992). The peak energy intake for females is at 11-14 years which is estimated as 2200kcals. For males, it is approximately 3000kcal at 15-18years.

Protein needs: Protein requirement also follow the growth pattern. The amount of protein needed for maintaining existing lean body mass as well as the accrual of additional lean body mass during the adolescent growth spurt influences the protein need of adolescents (Story and Stang, 2005; Brown, 2007; Brown *et al*,2013). Protein requirements per unit of height are highest for females from 11 - 14 years and 15 - 18 years for males , corresponding to the usual timing of peak height velocity (Story and Stang, 2005).When protein intakes are continuously inadequate, there may be growth declines, decreased accumulation of lean body mass and delays in sexual maturation (Brown, 2007).

Carbohydrates: Carbohydrates are the primary source of dietary energy for the body. Carbohydrate-rich foods sources include whole grains, fruit, legumes, and vegetables. Dietary

recommendations according to Story and Stang (2005) state that 50% or more of total daily calories must come from carbohydrate, with no more than 10-25% of calories obtained from sweeteners. Adolescents on the average consume close to 53% of their calories as carbohydrate (Maville and Huerta, 2002). However in developing countries, carbohydrate contribute more than 70% of the energy intake. (Latham, 1997; Young and Gherardin, 2008)

Fat: Story and Stang (2005) suggests that adolescents require dietary fat as well as essential fatty acids for normal growth and development. Adolescents consume less than 30% of calories from fat, with less than 10% of calories derived from saturated fat as recommended by the U.S. Department of Agriculture and U.S. Department of Health and Human Services (2010).

Calcium needs: Calcium is an essential element that maintains skeleton integrity with at least 99% of the body store of calcium found there (Choudhury, 2004). During the adolescent growth spurt, close to 45% of the adult skeletal mass is formed according to Sardesai (2011). For each centimeter increment in height, there is a 20g increase in body calcium (Choudhury, 2004).As a result, the RDA for calcium is increased from 800mg to 1200mg/d. Consumption of calcium rich foods during this period is very important. Sufficient calcium intake is essential for the development of dense bone mass as well as the reduction of the lifetime risk of osteoporosis and fractures (Sunyecz, 2008).

Iron needs: Iron is another vital element responsible for the transport of oxygen in the bloodstream, synthesis of deoxyribonucleic acid (DNA), and anaemia prevention (Abbaspour *et al.*, 2014). The iron need increases with the expansion of blood volume and rapid growth as well as muscle mass for adolescents. Iron needs for girls further increase at the onset of menstruation (Jacob and Nair, 2012). The recommended dietary allowance (RDA) for iron is 8 mg/day for 9 to

13 year olds, 11 mg/day for males between the ages 14 to18 and 15 mg/day for females ages 14 to18. (Trumbo *et al*., 2001)

Zinc: Zinc is linked with over 100 specific enzymes and is important for the formation of protein and gene expression (Story and Stang, 2005). The role of zinc in the human body as stated by Cousins (1996) can be classified by their catalytic, structure and regulatory functions. It is vital in adolescence by reason of its role in growth and sexual maturation. Males deficient in zinc experience delayed sexual development and growth failure (Sardesai, 2011; Sandstead, 2013). In response to the accelerated growth and hormonal changes during adolescence serum zinc levels decrease (Story and Stang, 2005; Roohani et al., 2013). The RDA for zinc for adolescents from 9 to 13 years is 8 mg/day. For males and females aged 14 to 18 years, the RDA is 11 mg/day and 9 mg/day, respectively. (Trumbo *et al*., 2001)

2.1.3 Global trends in adolescent nutrition

Individuals aged 10–24 years according to WHO (2009) as stated by Sawyer *et al*. (2012) constitute the majority of the world population (1·8 billion making up one-fourth of the world's population). A majority (90%) of them reside in low -income countries like Bangladesh,, Guinea, Nepal, Benin, Guinea-Bissau and Central African Republic and lower middle-income and higher middle-income countries like Ghana, Papua New Guinea, Nigeria, Morocco, South Africa, India, Pakistan and China where they make up a far greater fraction of the population than in high-income countries like Canada, Norway, Israel and United States because of a higher fertility rates. The spurt in adolescent populations concurs with a decline in malnutrition, infectious disease, and mortality in infancy and early childhood. The nutrition situation among adolescents have been studied across the continents in many countries both developing and developed from their

perception to food, prevalence of non- communicable such as obesity and overweight, food habit and so on. The results obtained are quiet revealing and begs for immediate attention. This review reflects some of the work of researchers who have published their results.

2.1.3.1 The case of developed countries

A study undertaken in Montreal, Canada a high income country by O'Loughlin *et al*. (1998) using 2108 children aged between 9 and 12 years who were living in multiethnic, low-income, inner-city neighborhoods revealed a high prevalence of overweight (35% of boys and 33% of girls all exceeded the 85th percentile for body mass index (BMI) and triceps skinfold thickness). Obesity (BMI greater than 95th percentile and triceps skinfold thickness) was found in 15% of boys and 13% of girls (O'Loughlin *et al*.,1998). Wang (2001) collected data on children aged between 6 to 18 from three countries (United States, Russia and China) in a nationwide survey (NHANES III,1988-1994; Russia,1992; China,1993) using a total sample size of 16021 (US-6110, Russia- 6883 and China-3028) revealed the prevalence of obesity and overweight at 11% and 14.3%. The Health Social Care Information Centre (2013) reported that the National Child Measurement programme data 2011/2012 in England, revealed that a fifth of pupil aged between 10 -11 were obese while 14.7% were overweight. Another health survey in England suggested differently that the prevalence of obesity had slightly dropped to 23.8% in 2011 in males compared to the prevalence recorded in 2004 (24.3%) Health and Social Care Information Centre, Lifestyles Statistics (2013).

2.13.2 The case of developing countries

Around 84% of adolescents aged from 10 to 19 years are found in developing countries according to a WHO working group (1982) in their report "Use and interpretation anthropometric indicators of nutritional status" as stated in Dasgupta *et al*. (2010). The double burden of malnutrition (overweight and underweight) and lifestyle related chronic diseases like hypertension, that confront developing countries usually stem from childhood and adolescence according to the WHO (2004) report on the global burden of disease. While malnutrition dwindles the body's ability to metabolize and absorb nutrients according to infection and disease on the other hand increase the body's nutritional demand resulting in a vicious cycle of worsened health ,infection and undernutrition, and sometimes death (WHO, 2004; Hotez and Kamath, 2009) .The devastating effects of infectious diseases is particularly common in developing countries creating a fertile ground for this cycle to exist (WHO,2004). Adolescents with compromised immune systems are highly vulnerable to malnutrition leading to continual reoccurrence of infections and disease that has a direct impact on the adolescent's psychological and physical development (Maziya 2014).

Leenstra *et al*. (2003) who worked on the prevalence and severity of malnutrition and age at menarche in two sites in western Kenya (Mumias and Asembo) with different malaria endemicity and degrees of malnutrition using a cross-sectional studies in adolescent schoolgirls and a sample size of 938 found that the overall prevalence of stunting and thinness was 12.1 and 15.6%, respectively. Two percent (2%) of the total were stunted severely. Menarche and start of puberty were delayed by approximately 1.5–2 years compared to a United State reference population.

A cross-sectional study by Singh and Devi (2013) in northern India among urban Meitei children and adolescent aged between 8 -18 years identified a high prevalence of underweight (30.2%) and overweight (3.1%) amongst males while the prevalence of underweight and overweight amongst the females was 33.86% and 5.18%.

In urban communities in Southern Ethiopia, Tesfalem *et al* (2013) in a study amongst high school adolescent from 6 non-governmental and 2 governmental school aged between 10 -19 also revealed that the prevalence of overweight and obesity of the study participants were 12.9% and 2.7% respectively.

A systematic review of adolescent age from 12-19 in Latin America and Caribbean countries by Rivera *et al*. (2014) identified that 16% to 35.8% of the combined national prevalence of overweight and obesity.

2.3 Effects of correctional centers and remand homes on nutrition and health

Children in correctional facilities and remand homes constitute a small fraction of about 0.5 – 2.5% of the overall prison population according to Sloth- Nielsen (2008).Correctional centres and remand homes are special facilities mandated by law where individuals who are in conflict with the law are kept and reformed. Remand prisoners are individuals in a pre-trial phase of their imprisonment and have not received their sentence (Andersen 2004).

The role of heads of Correctional Centres and Remand homes in providing nutrition and health is vital for the effective growth and well-being of their occupants. Denov (2010) in a report spelt out the nutritional states of children and their mothers in Sierra-Leone in prison. He stated that all of the children at the prison were malnourished because of the lack of variety in their diet

(no fresh vegetables or fruits, no meat and no milk). Breast-feeding mothers were also subjected to the same dietary restrictions. None of the women received dietary supplements. The children suffered from skin disorders. The lingering effects of malaria (such as anaemia) also persisted.

In Mozambique, Ehlers and Mathithi (2003) reported that children received decay and maggot infested food. Another study in Southern Sudan revealed that prison administrators had to finance the feeding of inmates in their care. The United States Department of State and Bureau of Democracy, Human Rights and Labour (2006) also reported food, ventilation, sanitation as poor as well as the almost non-existence of medical care in Gabon.

The United Nations Office on drugs and Crime (UNODC), (2013) asserts that prisoners have very serious health implications. They argue that prisoners are likely to have already existing health problems even before they enter the prison, since they are mostly from socio-economically deprived and poorly educated sectors of the general population, with little access to adequate health care. When there is overcrowding, poor nutrition, bad sanitation and limited access to fresh air and exercise their health conditions became worse off in prisons according to Goyer and Gow (2002) and UNODC (2013) increasing the prevalence of HIV infection, skin diseases, psychiatric disorders, hepatitis B and C, sexually transmitted diseases, tuberculosis, malaria, malnutrition, diarrhoea and injuries. Some of which have resulted in the death of some inmates as bemoaned by the annual report by the Ghana Prison's Service (2012).

The congested nature of most of the detention facilities in Ghana and Africa at large increases the likelihood of contracting respiratory diseases easily. Bridgwood and Malbon (1995) in their paper suggested that respiratory conditions like asthma were commonly reported by prisoners, with the female prisoners bearing more respiratory system complaints than the males.

Patrick *et al*. (2000) who assessed the health needs of one prison identified that the high turnover of inmates made it difficult to provide proper and effective management of chronic diseases.

The right to proper and quality health is the preserve of all individuals whether in prison or not. Unfortunately, this right is a mirage in prisons, where healthcare delivery services are extremely inadequate as a result of under-funding and understaffing. The right to health do not only encapsulates the access to curative, reproductive, preventive, supportive and palliative health care but also the access to the underlying basic determinates of health as depicted in the United Nations Children's Fund (UNICEF) (1998) malnutrition framework such as sufficient access to food; safe water and sanitation; adequate nutrition and housing; healthy environmental working conditions, health education and information as well as gender equality.

2.4 Juvenile offender rates in Ghana

Although information on the actual number of children incarcerated are often uncertain, Sloth-Nielson (2008) suggest that children living in correctional form a fraction of the overall prison population in Africa ranging from 0.5- 2.5%. The Ghana Prison Service annual report (2012) indicated that the average inmate population stood at 13,487 of which 117 were juveniles (representing 0.9% of the total population). Forty eight (48) of those adolescent offenders were new admission and were first time offenders. Even though there was a 3.1% increase in the inmate population as suggested by the Ghana Prison Service annual report (2013) juvenile inmates contributed about 0.7% (98 juveniles with 45 new admission) to the number. Statistics from the JGCC and BRH annual report stated that in 2013 (unpublished report), there were 86 admissions in total at the BRH. Eighty six (86) juveniles were discharged with 1 absconding and 5 had their case pending at the juvenile court. Six juveniles were brought forward from the previous year. The

JGCC in the same reporting year saw a total admission of 16 juveniles. Sixteen were discharged with 1 absconding and 18 had their case pending at the juvenile court. Twenty (20) were brought forward from the previous year.

Over the last three years data from the Ghana Prisons Service annual report and the JGCC and BRH annual report (unpublished report) showed that on the average, 56 adolescent offenders are admitted per year. At the JGCC, the number is quite low at the about 12 adolescent offenders per year. The situation is different at the BRH where the rate of admission stood at 91 offenders per year within the past three years. However, at this centre there was a high discharge rate which stood at 98% per year. Section 21 (4) of the Juvenile Justice Acts (2003), Act 653 suggests that a "Bail may be granted on the juvenile's own undertaking or with sureties from the parents, guardian, or close relative of the juvenile or a responsible person" which might have accounted for this rate.

2.5 Children Acts and the Criminal Code in Ghana

As mentioned earlier, adolescents are adventurous and sometimes in their bid to satisfy their curiosity they find themselves in conflict with the law. The framers of the law knowing this culminated in the passage of the Children's Act, 1998 (Acts 560) and the Juvenile Justice Act, 2003 (Act 653). Under this Act "a child is any person under the age of eighteen years". Coherent with this, the Juvenile Justice Act also define a juvenile as a person under eighteen years who is in conflict with the laws".

Under section 4 of Act 554, the age of criminal responsibility has been raised from 7 to 12 years in accordance with international standards which require that the age for child prosecution should not be pegged at low an age which would have the effect of negating the gains of juvenile

transformation. The formal Juvenile Justice System was established in the Gold Coast in 1946 by virtue of Section 54(B) of the Courts (Amendment Ordinance No. 23 of 1944. Remand homes, Industrial Schools, Juvenile Courts formed part of the initiative. Rules for their operations were all prepared.

Under Section 371 of the Criminal Procedure Code (Act 30) of 1960, industrial schools were established to cater for different categories of Juvenile offenders. These are the:

- Swedru Boys industrial School for those aged 14-16 years.
- Pong Tamale Industrial School for those aged 14-17 years.
- Borstal Institute, Accra now called the Senior Correctional Centre for young persons aged 17 and less than 21 years. Nonetheless, juvenile according to Hoffman and Baerg (2011) under the age of 18 years are sometimes sent to the Senior Correctional Centre if they commit a serious crime.
- Junior Boys' Industrial School at Sekondi for boys aged between 12-14
- The Osu Girls industrial School in Accra (for the whole country) for female juvenile offender now the Junior Girls Correctional Centre managed by the Social Welfare Department which jeeps both remand and convicted juvenile female.

Acts 653 provides significant institutional arrangements where the Minister responsible for Social Welfare (Ministry of Gender, Children and Social Protection) is to establish Junior Girls Correctional Centres (JGCCs) where juveniles may be detained. The Minister responsible for the interior is to establish Senoir Boys Correctional Centres (SBCC) where young offenders as the court determines may be detained. The only Senoir Correctional Centre is based in Accra and is solely for males. However the Ministry is expected to establish more around the country.

According to the Department of Social Welfare (2005), the purpose of its establishment is to:

1. Detain young offenders who have fallen foul of the laws of the land.

2. Conform to the first principle as established by 1995 Standard Minimum Rules for the treatment of prisoners (SMR) (Rule 8), the International Covenant on Civil and Political Rights, Article 10(2)(b) and the UN Convention on the Rights of the Child (1989) Article 37(c) which to ensure the compulsory separation young offenders.

Offenders in these correctional facilities are taught trades like carpentry, tailoring, basket, weaving, dressmaking and needlework, cookery, auto-mechanic, vulcanizing, welding, blacksmith, ceramics, general electrical , Draftsmanship, Shoe making and auto electrical so that when they are released they can fit into society and contribute their quota.

During their stay at the correctional centre or remand home, the juvenile has the right to:

1. Adequate food (UN Standards Minimum Rules for the Treatment of Prisoners, 1955)
2. Medical attention if necessary
3. Acceptable visits from guardians, parents, close relatives or lawyer and any other conditions reasonably needed for the juvenile. (Juvenile Justice Acts, 2003 (Act 653)

2.6. Care and management of inmates in Ghana

Section 35, 36 and 37 of the Prison Service Decree (1972) have set out the duties of the Director of Prisons in caring for prisoners. These sections talk about the health and welfare, cleanliness and accommodation of prisoners. Article 10 of the International Covenant on Civil and Political Rights (ICCPR) (1966) states “All persons deprived of their liberty shall be treated with humanity and with respect for the inherent dignity of the human person”.

The section on health and welfare covers the access to nutritious food, supply of toiletries, daily exercise, prompt supply of medication, special diets and anything supplied by the medical officer at post. This section further excludes certain punishment to be meted out to prisoners which includes changes in diet, reduction on the quantity of clothing and toiletries as well as prevention of access to medication. The cells, kitchen, washing and toilet facilities within the prison setting are to be kept in a clean and good sanitary condition at all times, as stipulated by the decree. A medical officer is required, by the provision of this decree, to certify in writing whether a prison cell is conducive for habitation after assessing the size, ventilation, fitting and any other necessities for improving health.

However, prisons in Ghana have failed to holistically implement national, regional and international standards and human rights laws in prisons despite signing to a number of treaties (Amnesty International, 2012). For instance, male prisoners experience unacceptable level of overcrowding, inadequate supply of food and access to health. Nonetheless inmates at the Senior Boys Correctional Centre do not experience overcrowding.

2.7. Safety and quality of food

According to the UN Standards Minimum Rules for the Treatment of Prisoners (1955) "Every prisoner shall be provided by the administration at the usual hours with food of nutritional value adequate for health and strength of wholesome quality and well prepared and served". Section 35.1a of the Prison Service Degree on Health and welfare of Prisoners also states that "It shall be the duty of the Director of Prisons to ensure that every prisoner is regularly supplied with wholesome and nourishing food in quantities sufficient to maintain him in good health".

Failure to meet this standard according to the International Covenant on Economic, Social and Cultural Rights (1966) would constitute a breach of the right to food under Article 11.1. Food shortages, inadequacies and the poor quality of food issues are major challenges and common feeding conditions in prisons across the world. The feeding situation in Ghana is just like other countries. The daily feeding rate in Ghana is GH¢1.80p (USD 0.47 using the Bank of Ghana exchange rate of 1 USD to GH¢ 3.80p at the time of the study) per prisoner. The inadequacies coupled with the poor quality cause many inmates to rely on families and other benevolent persons or organizations to provide them with food. This poor access to adequate food makes them susceptible to some deficiencies like anaemia which took the lives of some inmates in Ghana (Ghana Prison Service annual report, 2012)

2.8 Nutrition and health situation of adolescent prisoners

Adequate nutrition is required to achieve full growth potential and as such eating a nutritious diet during childhood and adolescent years will impact greatly on adult health (U.S. Department of Health and Human Services, 2015). On the contrary, failure to consume an adequate diet in this period can also cause health problems such as delayed sexual maturation and can stop or slow down linear growth as stated by Story *et al*. (2002).

A study among Burundian prisons showed that the food supply was insufficient both in total calories and in nutritional value for the inmates (Human Rights Watch, 2007). Adolescents (aged 13-18) were adversely affected. Adults and adolescents were given the same quantity of food: 350g of beans and 350g of manioc flour. Even though the inmates were fed, the nutrients were not wholly accessible to the body. The beans were not well-cooked, hence not very digestible, and the manioc flour was distributed uncooked. The adolescents did chores or solpart of their

rations to earn the use of older inmates' cooking pots and fuel. Salt and palm oil are good and relatively cheap sources of Vitamin A and iodine respectively, these micronutrients being of global health importance. However, the distribution of these ingredients in the prisons was rarely done (Human Rights Watch, 2007).

Another factor contributing to the inadequate amount of food for the adolescents, as portrayed in Burundian prisons, was the unfair sharing of portions by older prisoners in charge of food distribution where some received no food at all (Human Rights Watch, 2007). Furthermore, younger inmates could not count on extra supplies from home to supplement their diets (Human Rights Watch, 2007) and were thus restricted to receiving all necessary nutrients from prison rations.

Juvenile detainees as uncovered by Society for Adolescent Medicine (2000) have been identified as having seizure disorders, nutritional deficiencies, respiratory disease, orthopaedic skin as well as dental problems eventhough they have a physical check-up once a year and a dental check-up twice a year (U.S. Department of Health and Human Services, 2015).

One reason for the poor health status of incarcerated youth is that they have access only to health care services available in the institutions in which they are detained (Brown, 1993). This problem is not isolated to developing countries but the developed ones as well. In a study by Wilper *et al.* (2009) in the USA where they analysed the 2002 survey of inmates in local jails and the 2004 survey of inmates in State and Federal Correctional facilities using inmates 13years old and above. They determined that a portion of the inmates with a persistent medical condition had no medical examination. In addition, more than 1 in 5 inmates who took a prescription medication when they

entered prison stopped the medication after incarceration. Most inmates with serious chronic physical illness failed to receive care while they incarcerated.

Another study by Binwanger *et al.* (2009) who used data from the 2002-2004 National Health Interview Survey- sample file on individual aged 18-65 years and data used by Wilper *et al.* (2009). They asserted that inmates in jails and prisons had a higher burden of many chronic medical condition compared to the general population even though they adjusted for alcohol consumption and some important socio-demographic differences.

The nature of the health care system in detention settings is complex and multifaceted, leading to a decline in accountability and creating an environment for conflicts of interest (Society for Adolescent Medicine, 2000). The health of adolescent prisoners can be improved through adequate nutrition. Nourishing inmates through micronutrient supplementation improves their anti-social and offending behaviour (Sandwell and Wheatley, 2009). This study conducted in the United States of America and the United Kingdom also showed that offenders with low blood vitamin concentrations were significantly more likely to violate rules than those with normal concentrations (Sandwell and Wheatley, 2009).

2.8 Challenges at correctional facilities and the way forward.

2.8.1 The challenges

The challenges faced by correctional facilities are multifaceted and are usually similar across nations and continents. Some literature reviewed have indicated that the issues of growing prison populations and overcrowding; poorly ventilated buildings and abusive accommodation arrangements; inmate abuse, prison diseases and deaths ;unhygienic sanitary conditions; hunger;

food shortages and malnutrition, lack of medical care, etc. still remain the most common occurrence related to prison facilities across the world which according to the African Commission on Human and Peoples' Rights [ACHPR](2004); United Nations Office on Drugs and Crime ([UNODC] (2009) ,International Centre for Prison Studies ([ICPS] (2012)and Amnesty International, 2012) account for the inhuman treatment meted out to inmates in detention facilities.

Overcrowding in prisons is a major problem faced by many countries worldwide. James (2014) defined overcrowding as the difference between how many inmates the prison system is rated to hold and how many inmates the system is actually holding. The issue of overcrowding sometimes rears its ugly head even in some advance countries like the US where statistics obtained from the Bureau of Prisons as stated by James (2014) suggested that by the end of the 2011 fiscal year, overcrowding increased by 4% despite an expansion of the prison capacity by 30.7% . This trend was the highest since 2004, however, overcrowding dropped by 3% by the end of the 2013 fiscal year. The Odhikar Human Rights Report (2009) which originated from Bangladesh a developing country suggested that overcrowding was so severe that some prisoners had to sleep in shift. This situation was not different in Nigeria where according to Ayade (2010) in the metropolitan cities prison facilities hold inmates two to three times their capacity resulting in a situation where prison inmates can hardly move their limps and body as freely as they want to. Amnesty International Report (2012) on human rights in the Ghanaian prison alluded that the Ghana's prison system was failing to meet the standard as there were high levels of overcrowding. The Ghana Prisons annual report (2012) bemoaned that overcrowding still persisted. Nonetheless, they were optimistic that the "Justice for All programme" initiated by the Attorney General and Minister of Justice in 2007 would help decongest the prisons.

The causes for this menace in many countries according to Lappi-Seppälä (2010) are the excessive use of pre-trial detention; punitive "tough on crime" policies; lack of alternatives to imprisonment; application of rigid sentencing systems; excessively rigid early-release systems; unprepared welfare and medical systems; public fear of crime; and social inequality. Prisons worldwide are noted to have very large and tall building and high security fence according to ACHPR (2004). Nonetheless, the internal infrastructure according to the UNODC show a total disregard to human rights and welfare of incarcerated persons. Amnesty International (2012) added that prison cells had poor lighting or not at all, ventilation, sanitary condition, ceiling, floor and roof. In Israel, many prison facilities reported of extreme heat during the summer and freezing during the winter in addition to their already poor sanitary condition, insect infestation and impaired privacy of persons as a result of their structural conditions. Amnesty international (2012) reported that despite the high security and height of the building in Ghana, space and size were limited, ventilation was poor, wall were cracked and high illuminated light or darkness. A report from the Ghana National Review, Universal periodic report attested that the Government of Ghana had conceded that some prison buildings were old and not good for habitation.

High level of mental illness, communicable and chronic diseases, poor dental health, injury, disability and sexually transmitted disease according to Amnesty International (2012) and UNODC (2009) are noted to be associated with prisons across the world. The United States Department of State and Bureau of Democracy, Human Rights and Labour (2011) asserts that most of the common health disease that still persist in our prisons in Ghana and other countries around the world. Communicable diseases (HIV /AIDS) and non-communicable diseases (cancer, cardiovascular, cerebrovascular and liver disease) were among the ten leading ailment that caused death between the 2001 and 2004 fiscal year as documented by the U.S. Department of

Justice/Bureau of Justice Statistics (2007). The annual report by the Ghana Prisons Service (2012) documented Anemia, TB, cardial attack, liver disease, HIV/AIDS, Pneumonia and hypertension as among the leading cause of death. A total of 91 prisoners perished that year with the Eastern region recording the highest of 28 death while Greater Accra and Upper West recording no death. In 2009 Eighty-four (84) deaths were recorded whiles in 2010 Seventy- eight (78) deaths were recorded. The Australian Medical Association (AMA) (2012) strongly linked incarceration to poor health. This assertion can be understood due to the harsh conditions inmate go through daily like overcrowding, malnutrition, unhealthy condition, lack of medical care as a result of the lack of infirmaries and medical care as well as risky behaviours like drug Abuse. (Amnesty International, 2012; ICPS, 2012). The United States Department of State and Bureau of Democracy, Human Rights and Labour (2011) report that Ghana's infirmaries can provide minor medical services and basic drugs and had fewer nurses.

2.8.2 The way forward

The search by many countries and organizations to address challenges faced by prisons are still on going. For instance, Albrecht (2012);Amnesty international(2012); the Ghana Prison Service annual report (2012) ; Lappi-Seppälä (2012) ; James (2014) all suggest non-custodial as an alternative method in reducing overcrowding like the use of fine, community service, probation rehabilitative programmes and house arrest. The "Justice for all programme initiated by the Attorney General and Minister of Justice to help decongest the prisons by adjudicating remand cases without any opportunity for a court hearing. Baker *et al.* (2002) and ACHPR (2004) also argue for the expansion of Prison facilities and building as well as an increase in udget allocation to the welfare of prisoners as bemoaned by the Ghana Prison Service annual report (2012).

Amnesty International(2012) also suggest upgrade of spending on prisoner's food that will result in the " provision of food of adequate nutritional value to all prisoners, in a quantity and quality sufficient to satisfy the dietary needs of individuals, free from adverse substances, and acceptable within a given culture".

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research design

This was a cross sectional study among the inmates at the Senior Correctional Centre, Junior Girls Correctional Centre and the Boys Remand Home in Accra.

3.2 Research setting

The study was conducted at Senior Correctional Centre located at Roman ridge and the Junior Girls Correctional Centre and the Boys Remand Home at Osu all in Accra the regional capital of Greater Accra. The Senior Correctional Centre is a juvenile correction institute under the Ghana Prisons Service (GPS) where male offenders who are under 21 years old and are in conflict with the law are reformed while the Junior Girls Correctional Centre and the Boys Remand Home is under the Department of Social Welfare where offenders who are under 18 years old and are in conflict with the law are kept. The period that a convict spends in the correctional centre is aimed at reforming him or her so they can fit into society easily after their stay. On the other hand, inmates at the Boys Remand Home had not been convicted but still have their cases pending in a juvenile court.

Study population

The study population comprised of adolescents inmates at the Senior Correction Center, Junior Girls Correctional Centre and the Boys Remand Home in Ghana

3.3 Sample size determination

A target sample size was calculated based on Cochran's Formula (1977)**:**

$$n = \frac{t^2 \times p\,(1-p)}{m^2}$$

Where:

n = required sample size

t^2 = confidence level at 91%

p = estimated prevalence of underweight (BMI -for –age z score less than -2 SD) among adolescent boys in Ghana (33.8%) (Manyanga *et al*., 2014). The prevalence was adjusted to 35% considering that underweight for inmates will be higher than the national prevalence rate.

m^2 = margin of error at 9%

Thus:

$$n = \frac{1.70^2 \times 0.35(1-0.35)}{0.09^2} = \frac{2.98 \times 0.2275}{0.0081} = 81$$

5% mark up to cater for attrition because they were institutionalized. Approximately 85 inmates were required for the study.

It was observed that inmates at the JGCC and the BRH were relatively few, and hence it was decided *a prori* that if, at the time of data collection, inmates at any of those two centers were less than 10, they would all be included in the study, and the rest of the study participants would be recruited from SBCC, which had a larger population of inmates.

3.4 Inclusion criteria and exclusion criteria:

Inmates were included if (a) they had spent a minimum of 4 weeks or more at the centre ; (b) were willing to participate in the study (c) they met the WHO (2007) age cut-offs for adolescence i.e. 10 -19 years . Inmates were excluded if there were ill, and required immediate hospital visit.

3.5 Data collection

Nutritional inadequacies during the period of adolescence as stated by Dasgupta *et al.* (2010) can hypothetically retard growth and sexual maturation. The nutritional status can well be understood by correlating information from various sources, the most important being growth and other anthropometric data, dietary intake measurement, clinical assessment and socio-demographic data. Aside the need to address the nutritional inadequacies, information about the environmental factors like sanitation and health centre can help explain their nutritional situation.

A pretested questionnaire was administered to obtain information on the background information, as well as data on physical activity and dietary pattern. A key informant interview was conducted to obtain information on funding, food security and storage facilities. Participants' weight (Omron HBF-400 Body Fat Monitor and Scale), and height (Charder HM200P Portstad Portable Stadiometer). Physical appraisal were done to obtain clinical data.

3.6 Informed consent

Informed consent was obtained from all the participants and their willingness was required after the objectives of the study were thoroughly explained to them. They were assured of confidentiality in the management of the information that they would provide. The questionnaires

did not include information on their names. Questions were read out to them in their preferred local dialect and their responses were recorded.

3.6.1 Background information

This included age, sex, length of stay at the Correctional Center, crime committed and area of residence.

3.6.2 Dietary data

Dietary information was collected using the method of daily weighed food intake. A portion of the food was taken for proximate analysis.

The individual weighed food intake was carried out during breakfast, lunch and supper. Using convenience sampling a sub-sample was obtained for this purpose at the Senior Correctional Centre. On the other hand, inmates at the Junior Girls Correctional Centre and Boys Remand Home all inmates were used. A compact dietary scale was used to measure individual food portions at meal times. Plate wastes was taken into consideration and deducted from the original weight of the food. This was conducted on two week days (Monday and Wednesday) and on one weekend (Saturday).

3.6.2.1 Food samples collection

Eighteen different meals (9 at each location, Osu and Mamobi) were obtained on 3 different days (2 weekdays and 1 weekend) on the same days the weighed food intakes were conducted. Samples were collected from the kitchen into a stomacher bag kept cool in an ice chest containing

ice gels. Food that had different components to make one complete meal were collected in their separate forms. For instance, "koko" (cereal porridge consumed in Ghana) and bread were separately collected into separated stomacher bags.

3.6.2.2 Sample preparation prior to analyses

Samples of the meals served to the inmates were collected and sent to the laboratory where their various nutritional components were determined Ten percent (10%) of the actual weight of food consumed was taken from the portion size given by the kitchen to mimic the actual food they consumed. For instance, the mean Koko and bread by the inmates at the JGCC and the BRH who consumed prepared by the same caterer was 414.5g and 120.5g respectively. Ten percent (10%) of this food (41.4g and 12.0g) was taken from prepared portion size given by the kitchen to mimic the actual food they consumed. This was done to get a representative of the food before homogenization. Both koko and bread were homogenized and kept in a stomacher bag, sealed and labelled. This was done at the end of each collection day. The homogenized samples were stored at -4^{o}C until the last day of analysis. Moisture was determined before storage.

3.7 Proximate analyses

3.7.1 Moisture content

The procedure was carried out according to Pearson (1976). Moisture dishes with their lids were thoroughly washed and dried to a constant weight in an air oven (Genlab™,Model-MINO175/F) and cooled in a desiccator. About 2.0g of samples were then weighed into the dishes and covered with a lid. It was then dried to a constant weighed at 105^{O} Celsius overnight in an air

oven. The dishes were cooled in a desiccator and weighed the next day. The loss in weight (grams) was recorded as the moisture content of the meal samples.

3.7.2 Crude protein determination

The Kjedahl method was used in the determination for protein according to Anderson and Ingram (1989). It included three major steps:

- Digestion
- Distillation
- Titration

Approximately 2g of the blended sample were weighed into a digestion tube. A spatula full of N- catalyst was added to speed up the reaction. The mixture was thoroughly shaken and a 25ml concentrated Sulphuric acid 95% purity was added by carefully pouring it down the side of the flask and then swirled gently. The mixture then turned black upon the addition of the acid. The mixture was then heated on a Block Digestion System 20; 1015 Digestion in the fume chamber. The temperature knob on the digester was set 6. The heating was maintained at a constant temperature for about an hour and a half (90 minutes) until a clear solution was obtained. The digest was then transferred quantitatively into a 100ml volumetric flask and made to the mark with distilled water. A blank sample was also prepared.

Distillation

About 100ml of 2 % Boric acid was measured and a few drops of mixed indicator added in an Erlenmeyer flask. A 10ml of distilled water was added to the digestion flask and shaken to dissolve any precipitate. Approximately 80ml of 0.1 NaOH was added to neutralize the acid to

create an alkaline solution. The Buchi Distillation Unit K. 314 was used for the distillation process. The distillate was collected in the 2% Boric acid.

Titration

The distillation was titrated with 0.01N HCl for three experimental samples. The percentage nitrogen was calculated using the formula given by FAO (2003):

$$\%\text{Nitrogen} = \frac{\text{Titration value} \times \text{Vol. of Extract} \times 100\% \times 0.01\text{N HCL} \times 14}{\text{Weight of sample} \times \text{Aliquot} \times 1000}$$

Where;

14= the molar mass of nitrogen

1000= constant

% Protein= % Nitrogen x Conversion Factor (6.25)

3.7.3 Crude fat determination

The Soxhlet method was used in the determination of fat according to Pearson (1976). Approximately, 2g each of the sample were weighed into a thimble and plugged with a fat free cotton wool and placed into the extraction tube gently by allowing to slide gentle down the side of the tube. A clean dried round bottom flask was weighed and then filled to half its volume with petroleum ether. It was then fixed to each condenser to collect the fat. The setup was carefully adjusted and refluxed for three hours. After the set time, the extractor was disconnected and the thimbles were lifted to the top of the tube with tongs and clipped to the sides to drain. The thimbles were then placed in an air oven at a temperature of 60^{O} Celsius. The ether was then reclaimed and the round bottom flasks were dried in the oven to remove all traces of moisture and ether. Each sampled was analyzed in triplicate. Gain in weight in grams of the flasks was calculated as the fat content of the sample.

3.7.4 Crude fibre determination

The entire residue from the ether extraction was transferred quantitatively from the thimble into a 600ml beaker. About 0.5g of salt (ignited asbestos fibre) was added, exactly 200ml of 1.25 sulphuric acid (H_2SO_4) was added and boiled gently for 30minutes with the beaker covered with a large watch glass, boiling distilled water was added at interval to maintain the volume of the mixture. After boiling, the mixture was filtered through a sintered glass Buchner funnel with suction. The residue on the filter was then washed with boiling water, then washed into a beaker with 200ml of boiling 1.25 NaOH for 30minutes. This was done carefully so as to prevent frotting. Filtration was done after boiling through a sintered glass Buchner funnel, then washed with hot distilled water and then with 100ml 1% hydrochloric acid (HCL) and finally hot distilled water. The residue was transferred quantitatively into a silica ignition dish dried to a constant weight using an air oven at 105^{O}C and ignited in the muffle furnace at dull red heat (550 to 600 degree Celsius). It was then cooled, weighed and reported in grams as percent fibre of the sample (AOAC, 2010). The analysis was done in triplicate.

The tea–bread mixture samples were determined using the gravimetric Rose – Gottlieb process a prescribed reference method for determining fat in milk according to Kirk and Sawyer (1991). Approximately 2 grams of the homogenized tea-bread sample were weighed into a previous dried at 100 ºC, cooled and weighed conical flask. 1ml of 0.88 ammonia solution was added to the sample and mixed. This mixture was transferred into a 200 ml separating funnel. 10 ml of alcohol (95%) was added. A solvent mixture of peroxide free diethyl ether and a recently distilled light petroleum spirit (40 - 60ºC) in a ratio of 1:1 was prepared. 50ml of that mixture was added to the contents in the separating funnel, corked and vigorously shaken for 30 seconds. After

separation was complete, the fat solution was transferred into a conical flask (previous dried at 100 ºC, cooled and weighed). Two successful weight of 5ml of mixed solvent ethers were added to the nonfat solution (without shaking) and transferred to the separating funnel. The extraction was repeated using 30ml of the solvent mixture followed by separation. This step was repeated again. The fat solution layer was distilled off from the separating funnel into a conical flask and was evaporated for at 100 ºC. The gain in weight by conical flask after evaporation was the weight of the fat present in the sample.

3.7.5 Ash determination

Ash determination according to Belitz *et al.*, (2009), involved weighing about 2g of the sample into previously conditioned crucibles. The weight of each of the crucible was recorded prior to that. The samples in the crucibles were placed in the hot furnace at 600^{O}C for 6 hours. After the set time, the muffle furnace was turned off and the crucible allowed to cool overnight. Gain in weight of crucible was calculated as ash. Determination was done in triplicate for each sample.

3.7.6 Carbohydrate determination

Determination was by differential method. This was done by subtracting the sum of moisture content, protein, fat and ash from 100.

3.7.7 Mineral content determination

The mineral contents of their meals were determined using the Atomic Absorption Spectrum (AAS), (Perkin-Elmer Corp, 1968). The minerals determined were Ca, Zinc and Iron.

Each meal was digested by treating the sample with a ternary acid mixture made from concentrated nitric acid, concentrated sulphuric acid and perchloric acid.

Approximately 1g of the meal sample was weighed into a 125ml Erlenmeyer flask. About 10ml of the tertiary mixture was then added to it. The content was mixed and heated at a low to medium heat on a hot plate under a perchloric acid fume. Heating was continued for about thirty minutes until dense white fumes from the sulphuric acid appeared.

The mixture was then allowed to cool and then to 40ml to 50ml of distilled water added to it. It was then boiled on the hot plate at medium heat. The mixture was then allowed to cool to room temperature and filtered with a wash bottle into a 100ml Pyrex volumetric flask. It was then made up to the mark with distilled water. (The solution was then stored for the heavy metal up to the mark with distilled water). The solution was then stored for the heavy metal determination using the Perkin-Elmer Analyst 400. The iron content of the sample was read at a wavelength of 248.33 and Zinc read at 213.

Calculation for minerals present:

The minerals determined were iron, Ca and Zn

$$\% \text{ Mineral (e.g. Iron)} = \frac{\text{AAS reading}}{1000} \times \frac{100}{1000} \times \frac{100}{\text{Weight of sample}}$$

Weight of sample taken = 1g

Converting to mg/kg = % Mineral x 10000

“As is” values of the proximate analyses obtained were converted to dry matter by the formulae below, for instance:

$$\text{Fat content on “dry matter basis”} = \frac{\text{"As is" of fat x 100}}{(100 - \text{Moisture content of that sample})}$$

$$\text{Protein content on “dry matter basis”} = \frac{\text{"As is" of Protein x 100}}{(100 - \text{Moisture content of that sample})}$$

3.8 Anthropometry measurements

Anthropometric measurements according to Bisai *et al*. (2012) have become a common tool used to determine the nutritional status among children and adolescents. Compared to other anthropometric indicators, body mass index (BMI) is not only the single most appropriatebut cost-effective and non-invasive tool for assessing adolescents and adults nutritional status (WHO, 1995; Bisai *et al.*, 2012). de Onis *et al*. (2001) also adds that it is also the best pointer of thinness during adolescence.

BMI of the inmates was calculated. Heights of the participants were measured using a portable stadiometer (Charder HM200P Portstad Portable Stadiometer) according to standard procedure as described by Gibson (1990). The participants were asked to stand without shoes. The moveable headboard was lowered until it firmly touched the upper part of the subject’s head and a direct reading of height obtained. The readings were converted to meters. The participants were then asked to stand on the scale with their feet slightly apart and head in an upright position.

Weight was measured using the seca scale to the nearest 0.01kg. The height was taken using a Stadiometer to the nearest 0.01. The BMI for each participant was then calculated using the formula;

$$\text{BMI} = \text{Weight (Kg)}/\text{Height (m}^2\text{)}$$

3.8 Physical activity

Physical activity for this study was defined as any movement of the body produced by skeletal muscles that will necessitate the expenditure of energy (WHO, 2015). Participants were asked about the activities they usual indulged in and the estimated time (minutes) per day they performed that activity.

3.9 Clinical Data

Clinical assessment involved the determination of a person's nutritional status by looking for overt or visible symptoms of nutritional deficiency. Physical appraisal were done by observing skin (for Xerosis, Pellagrous dermatosis, Flaky paint dermatosis and Oedema), eye (for Bitot spots, pale conjunctiva and Keratomalacia), hair (for lack of lustre, thinness of sparseness, easy pluckability), teeth (for mottle enamel), gums (for sponginess and bleeding) and tongue (for Glossitis and redness of tongue), lips (for Angular stomatitis and Chelosis) and palpating the thyroid gland (for visible and palpable goiter). Resting systolic and diastolic measurement were measured on the left arm of the subject using clinical validated digital Omron automatic blood pressure monitor (HEM -172CN2; Omron, China).

3.10 Data capture and analysis

Data entry and statistical analysis were performed using Statistical Package for the Social Science (SPSS) version 16.0 software package. Frequencies were used to summarize categorical variables such as sex and level of education while means and standard deviation were reported for continuous variables. Their sex adjusted BMIZ was calculated using WHO (2007) reference value for children 10-19 years of age as developed by de Onis et al (2007). Inmates whose BMIZ was >

-1SD were classified as low BMIZ whiles inmates whose BMIZ were ≥ -1SD were classified as normal. To determine factors related to low BMIZ among inmates, a set of 9 potential factors were first identified, namely sex, age, being at JGCC, being at SBCC, being at BRH, illness in the preceding the study, length of stay, average number of times they ate per day and whether they avoided certain foods. Next, a univariate analysis (Pearson's correlation) was used to determine which of those potential factors were related to low BMIZ of inmates. Those factors found to be associated with low BMIZ were then used for multiple logistic regression analysis, which was used to estimate odds ratios (OR) and 95% confidence intervals (CI) for the regression parameters. A *P*-value <0.10 was used in the univariate analysis to select factors for the multivariate logistic analysis, and a *P*-value < 0.05 was considered significant in the multivariate logistic analysis Even though their length of stay and their avoidance of eating certain foods were not significant, it was included in the logistic regression because it could have an effect their nutritional status. All differences were considered statistically significant at *P* value < 0.05.

Nutrient intakes were determined from the food intakes using FCT and through laboratory proximate analysis (LPA).Data from the moisture, fat, fibre, ash, iron and zinc were represented as mean ± standard deviation of three experimental determinations using Microsoft Excel software. The Recommended Daily Allowance (RDA) for adolescents was used to compute their nutrient adequacy ratio (NAR) and their Mean Adequacy Ratio (MAR) for their overall adequacy of diet. The NAR for a given nutrient according to Torheim *et al.*, (2003) and Sinko *et al.* (1995) is the ratio of the amount of nutrient in a diet to the RDA for that nutrient. Each of the 7 NARs in Table 4.6 was truncated at 1, so that a nutrient with a high NAR would not compensate for another nutrient with a low NAR as stated by Torheim *et al.* (2003). The MAR was computed as the mean of the 7 NARs. Thus the MAR of 1 indicates that the overall adequacy of the nutrient is equal to

or above the recommended intake. Nonetheless the higher the overall adequacy of the diet the closer the MAR will be to 1 (Simko *et al.*, 1995). The more the MAR falls below 1, the higher the probability that the diet failed to meet the needs of the inmates. The NAR values were based on recommendations adopted from the Institute of Medicine of the National Academies (US), Food and Nutrition Board, Panel on Macronutrients, Subcommittees on Upper Reference Levels of Nutrients and Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (2005) and Hellwig *et al.* (2006).

3.10 Quality assurance

To ensure the validity of the information gathered, the following measures were put in place;

- Pretesting of questionnaire was done to ensure adequacy of coverage, clarity and consistency of questionnaires.
- Instruments were calibrated before use.
- All measurements were taken in duplicates.
- All measurements were accomplished using standard procedures.

3.11 Ethical considerations

Ethical clearance was sought from the Internal Review Board (IRB) of Noguchi Memorial Medical Research Institute, University of Ghana (NMIMR-IRB CPN 020/14-15 *amend.* 2015). The study was thoroughly explained to the Participants and they were recruited into the study after they had given their consent and signed an informed consent form. All information provided by study participants were confidential with only project personnel (the researchers, and field staff). All data were linked to a unique project ID code; the list of codes and participant names will be

kept separately and locked. Staff handling all individual data were trained in ethics and confidentiality issues. All discussions took place in a space where confidentiality was assured.

CHAPTER 4

4.0 RESULTS

The data collection started from August 2014 and ended in November 2014. Seventy nine (79) inmates took part in the study. The number of inmates at the JGCC and BRH were smaller and hence all of them were approached for consent as decided *a priori*. The rest were obtained from the SBCC.

4.1 Reported background characteristics of inmates

Table 4.1shows that, 73 (92.4) of the study participants were males. The inmates at the Senior Boys Correctional Centre (SBCC) contributed 69 (87.3%) to the entire sample .More than 80% of the study participants were between the ages of 15-19 years. Approximately 99% of the study participants were first time offenders. Majority of the participants 43 (54.4%) had the education truncating at the primary school level. More than half of the study participants, 60 (75.9%) had been incarcerated for less than 13 months. Christians, 59(74.7%) were the major religious group among the study participants. Majority of the inmates 46 (58.2%) often engaged in social activity. More than 80% of the inmates reported as usually feeling lonely with 38 (48.1) saying sometimes and 28 (35.4%) saying often.

Table 4.1: Reported background characteristics of inmates (n=79)

Variable	n (%)
Sex	
Male	73 (92.4)
Female	6 (7.6)
Institution	
SBCC	69 (87.3)
JGCC	6 (7.6)
BRH	4 (5.1)

Table 4.1 cont'd: Reported background characteristics of inmates (n=79)[I]

Variable	
Age*	16.6 ± 1.5
10-14	10 (12.7)
15-19	69 (87.3)
Level of Education	
Primary	43 (54.4)
JHS	29 (36.7)
SHS	7 (8.9)
Length of stay at centre	9.1 ± 7.4
1-12 months	60 (75.9)
13-24 months	16 (20.3)
Above 24 months	3 (3.8)
Religion	
Christian	59 (74.7)
Muslim	18 (22.8)
Traditional	2 (2.5)
Former region of stay	
Greater Accra	23 (29.1)
Central	11 (13.7)
Volta	9 (11.4)
Eastern	7 (8.9)
Ashanti	14 (17.7)
Other[a]	15 (18.9)
Offense committed	
Theft	57 (72.1)
Defilement	9 (11.4)
Other[c]	3 (3.8)
Number of times at institution	
First	78 (98.7)
Second time	1 (1.7)
Engagement in social activity[b]	
Never	6 (7.6)
Sometimes	27 (34.2)
Often	46 (58.2)
Usually feel lonely	
Never	13 (16.5)
Sometimes	38 (48.1)
Often	28 (35.4)

[I] Values are mean ± SD, or number (%)
[*]Age in completed years
[a]Brong Ahafo, Upper West, Western, Upper East
[b] religious activities, durbars, games
[c] Assault, aiding and abetting, smoking, robbery, manslaughter

4.2 Reported morbidity in the month preceding the study

The table below shows the reported morbidity of the inmates. A minority of the inmates 33(41.8%) fell ill in the month preceding the study. About 88% of the inmates took medication, however, 22 inmates representing 75.9% did not know the name of the medication.

Table 4.2: Reported morbidity of the inmates (n=79)

Variable	n (%)
Fallen ill in the past month	
Yes	33 (41.8)
No	46 (58.2)
Took medicine for illness n=33	
Yes	29 (87.9)
No	4 (12.1)
Idea of medicine (n=29)	
Yes[b]	22 (75.9)
No	7 (24.1)

[b] paracetamol, multivite, chloroquine

4.3 Reported dietary patterns of the inmates

Majority of the inmates 49 (62.0%) said they usually had good appetite and more than 40% of them reported often feeling hungry. Furthermore, 43 (54.4%) of the inmates avoided certain foods even though 73 (92.4%) of the inmates ate 3 times on average and their eating time being regular 78 (98.7%). Breakfast 24 (30.4%) was the most frequently skipped meal with taste and appearance 19 (33.3%) being the main reason for skipping the meal. More than 70% of the study participants consumed no snack. Approximately 41% of the inmates never received food outside while 23 (29%) received food occasionally.

Table 4.3: Reported dietary patterns of the inmates n= 79

Variable	n (%)
Usual Appetite	
Good	49 (62.0)
Fair	17 (21.5)
Poor	13 (16.5)
Usually feel hungry	
Never	26 (32.9)
Sometime	17 (25.3)
Often	33 (41.8)
Avoid Eating certain foods	
Yes	43 (54.4)
No	36 (45.6)
Average number of eating	
1 -2 times	4 (5.1)
3 - 4 times	73 (92.4)
> 4	2 (2.5)
Regular time of eating	
Yes	78 (98.7)
No	1 (1.3)
Meals usually skipped	
Breakfast	24 (30.4)
Lunch	15 (19.0)
Supper	17 (21.5)
None	22 (27.8)
All meals	1 (1.3)

Table 4.3 cont'd: Reported dietary patterns of the inmates n= 79

Variable	n (%)
Reason	
Appetite	5 (8.8)
Total dislike	11 (19.3)
Dislike of accompaniment	12 (21.0)
Taste and Appearance	19 (33.3)
Monotonous food	5 (8.8)
Other [a]	5 (8.8)
Usually consume snacks	
Yes	21 (26.6)
No	58 (73.4)
Type of snack consumed n=21	
Sweet	21 (100)
Savories	0 (0)
Time of consumption	
Morning	5 (23.8)
Afternoon	7 (33.3)
Evening	2 (9.6)
Anytime	7 (33.3)
How often is food received from outside	
Never	32 (40.5)
Daily	4 (5.1)
Once a week	5 (6.3)
2-3 times a week	6 (2.5)
More than 3 times	2 (2.5)
Once a month	7 (8.9)
Occasional	23 (29.1)

[+]received food outside the institution at least once every 3 months based on responses given

[a]refer to appendix

4.4 Foods served during the survey period

Table 4.4 shows a list of all meals consumed at the three survey locations. The list comprised of breakfast, lunch and supper. Koko was the most predominant meal consumed at breakfast. Rice was either consumed as lunch or supper with either stew or soup.

Table 4.4: Foods served during the survey period

Institution	Breakfast	Lunch	Supper
JGCC[a] and BRH[a]	Tea and Bread	Beans and Gari	Rice, macaroni and Beans stew
	Koko* and bread	Rice, macaroni and tomato stew	Rice, macaroni, Beans stew and Fish
			Banku, okro and fish
SBCC	Koko*	Rice, palm nut soup and fish	Banku, palm nut soup and fish
		Rice, groundnut soup and fish	Banku, groundnut soup and fish

***** A cereal porridge
[a] Consumed food from the same pot (food was prepared by the same cook in bulk and distributed)
SBCC- Senior Boys Correctional Centre
JGCC-Junior Girl Correctional Centre
BRH- Boys Remand House

4.5 Average intake of inmates using the food composition table (FCT) and the laboratory proximate analysis (LPA)

Table 4.5 shows the energy and nutrient intakes of the inmates using the food composition table and the standard analytical method. Inmates at the BRH had the higher intakes of both the macro and micro nutrient under investigation using both methods. For instance the carbohydrate value for the inmates at the BRH was (422.03 ± 62.09) g/d while that of the inmates at the SBCC was (245.51 ± 20.85) g/d. For the two methods, the difference between the FCT value and the AM value for carbohydrate was 200g/d.

Table 4.5: Average intake of inmates using the food composition table (FCT) and the laboratory proximate analysis (LPA)

	JGCC(n= 6)			BRH (n= 4)			SBCC (n= 10)
Variable	**FCT [n]**	**LPA**	**Difference**	**FCT**	**LPA**	**Difference**	**FCT**
Energy (kcal/d)	1728.75 ± 360.05	525.23 ± 45.5[*]	1203.75	2450.95 ± 458.06	702.48 ± 96.40[*]	1748.47	1354 ± 275.41
CHO (g/d)	297.80 ± 41.90	97.52 ± 3.80[a]	200.28	422.03 ± 62.09	133.91 ± 18.48[a]	288.12	245.51 ± 20.85
Protein (g/d)	34.68 ± 9.44	13.23 ± 3.24[b]	21.45	50.92 ± 9.93	17.74 ± 2.28[b]	33.18	32.92 ± 10.06
Fat (g/d)	45.97 ± 24.91	9.13 ± 3.24[c]	36.84	65.40 ± 31.14	12.22 ± 3.86[c]	53.18	36.06 ± 10.91
Fe (mg/d)	15.45 ± 8.62	3.10 ± 1.67[d]	12.35	21.64 ± 9.10	1.13 ± 0.25[d]	20.51	17.63 ± 0.70
Zn (mg)	5.10 ± 1.39	0.37 ± 0.12[d]	4.73	7.72 ± 1.38	0.52 ± 0.14[d]	7.20	6.95 ± 0.69
Ca (mg)	260.0 ± 48.28	15.31 ± 12.63[d]	244.69	378.29 ± 47.65	20.22 ± 16.05[d]	358.07	260.17 ± 6.51

Values are mean ± SD

***-** Sum of calories supplied by CHO, Fat and Protein by calculation

[a]- Differential method

[b]- Kjedahl method

[c]- Soxhlet method for solid sample, Gravimetric Rose-Gottlieb method

[d]- Atomic Absorption Spectrum method

[n] Nutrient values obtained from the RIING nutrient database and Food processer data base

SBCC- Senior Boys Correctional Centre

JGCC-Junior Girl Correctional Centre, BRH- Boys Remand House

4.6 Nutrient adequacy ratio of inmates based on the FCT and the LPA

This table shows the Nutrient Adequacy Ratio (NAR) of the dietary intake of the inmates based on the two methods of assessment. For instance, the FCT values of inmates at the JGCC showed that their NAR for energy (72.8%), Carbohydrate (173.6%), Protein (75.4%), Fat (153.2%) and Fe (103.0%) met at least 60% of their daily requirement while Zn (56.7%) and Ca (20.0 %) did not meet at least 60% of their daily requirement. The LPA values of inmates at the same centre showed that their NAR for carbohydrate (75.02%) was the only nutrient that met at least 60% of their daily requirement.

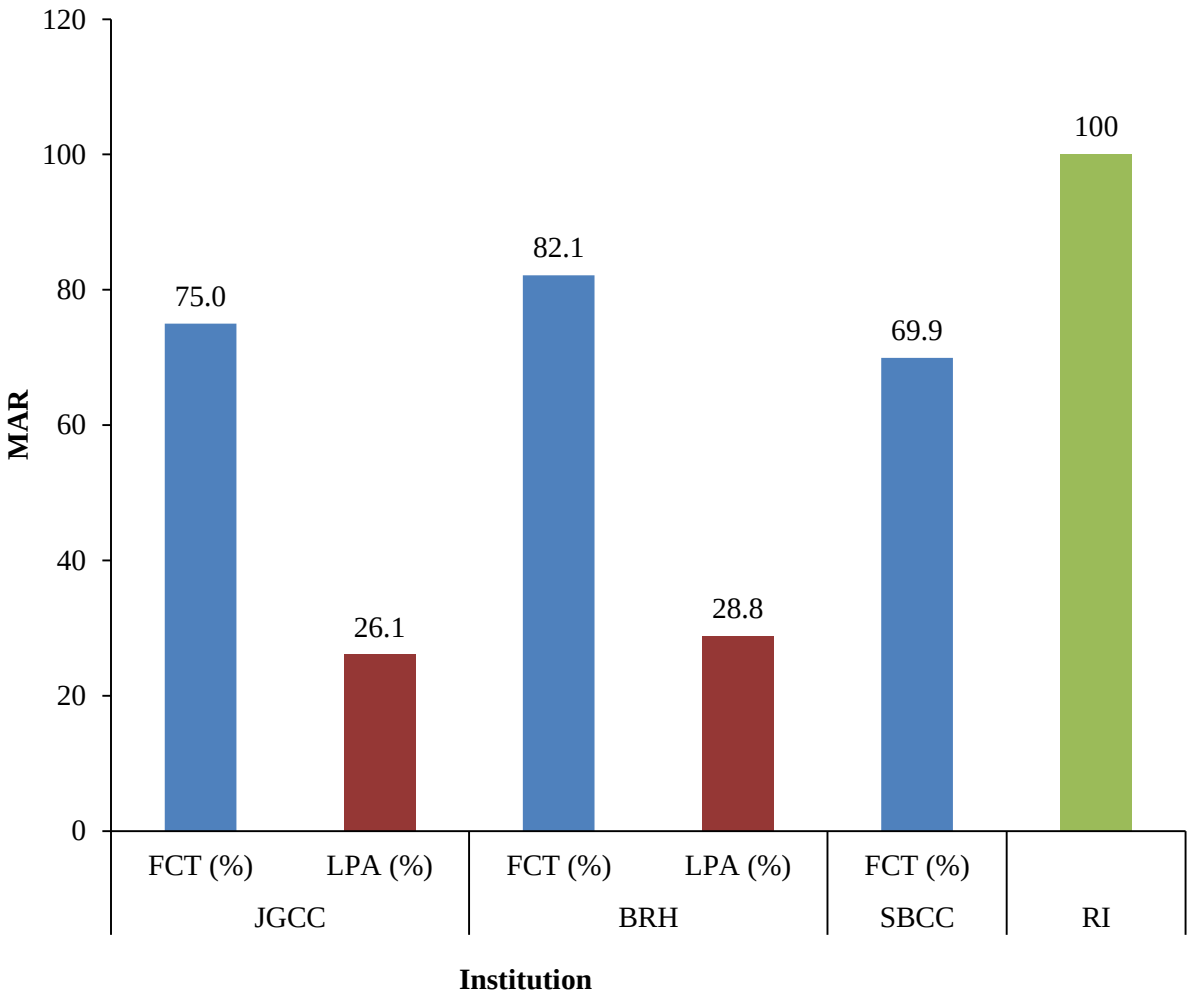
Table 4.6: Nutrient adequacy ratio of inmates based on the FCT and the LPA

	JGCC (n= 6)		BRH (n= 4)		SBCC (n=10)
Variable	**FCT (%)**	**LPA (%)**	**FCT (%)**	**LPA (%)**	**FCT (%)**
Energy (kcal/d)	72.79	22.18	77.76	22.29	42.96
CHO (g/d)	173.61	75.02	324.63	103.01	188.85
Protein (g/d)	75.39	28.75	97.92	34.11	63.30
Fat (g/d)	153.22	30.45	217.99	40.73	120.20
Fe (mg/d)	103.00	20.73	196.69	37.72	160.27
Zn (mg)	56.69	4.11	70.26	4.72	63.18
Ca (mg)	20.00	1.17	29.10	1.55	20.00

SBCC- Senior Boys Correctional Centre, JGCC-Junior Girl Correctional Centre, BRH- Boys Remand House
FCT- Food composition table
LPA- Laboratory proximate analysis,
The DRI values were adapted from the DRI reports, see www.nap.edu

4.7 Mean adequacy ratio (MAR) of inmates based on the FCT and LPA

The inmates' MAR based on the FCT met about 75% their overall dietary requirement whiles the MAR based on the LPA met about 26.1% of their overall dietary requirements of the inmates at the JGCC. The same trend was observed at the BRH. Amongst the institutions, inmates at the BRH recorded the highest MAR with SBCC recording the least using the FCT.



RI- Recommended intake
SBCC- Senior Boys Correctional Centre
JGCC-Junior Girl Correctional Centre
BRH- Boys Remand House
FCT- Food composition table
LPA – Laboratory proximate analysis

Figure 4.7: Mean adequacy ratio (MAR) of inmates based on the FCT and LPA

4.8 Anthropometric measurements of study participants

Table 4.7 shows the anthropometric measurements of inmates. The mean BMI for the entire group was 20.50 ± 50 kg/m^2. The males recorded 20.24 ± 1.94 kg/m^2 whilst for the female, a BMI of 23.69 ± 5.28 kg/m^2 was recorded. The BMI-for-age z-score for the entire group was -0.22 ± 0.84. The males recorded a BMIZ of -0.30 ± 0.76 whilst for the female a BMIZ of 0.67 ± 1.28 was recorded.

Table 4.8: Anthropometric measurements of study participants (n=79)

Variable	Male[+]	Female[o]	Overall
Weight (kg)	56.09 ± 7.74	56.23 ± 13.63	56.25 ± 8.21
Height (m)	1.66 ± 0.01	1.57 ± 0.06	1.66 ± 0.08
BMI (kg/m^2)[n]	20.24 ± 1.94	23.63 ± 5.28	20.50 ± 2.47
BMI-age z score	-0.30 ± 0.76	0.67 ± 1.28	-0.22 ± 0.84

[1]Values are mean ± SD
[+] Inmates from the Senior Boys Correctional Centre (SBCC) and Boys Remand Home (BRH)
[o] Inmates from the Junior Girls Correctional Centre (JGCC)
[n] Calculated based on the formula [BMI= (weight (kg)/ [height (m^2)]^2

BMIZ-BMI-age z score

4.8 BMI classification of study participants

This figure shows the number of inmates by BMI for age z-score classifications. More than half of the inmates 65 (82.3%) had a normal BMI-age z score. The remaining had a low BMI 14 (17.7%).

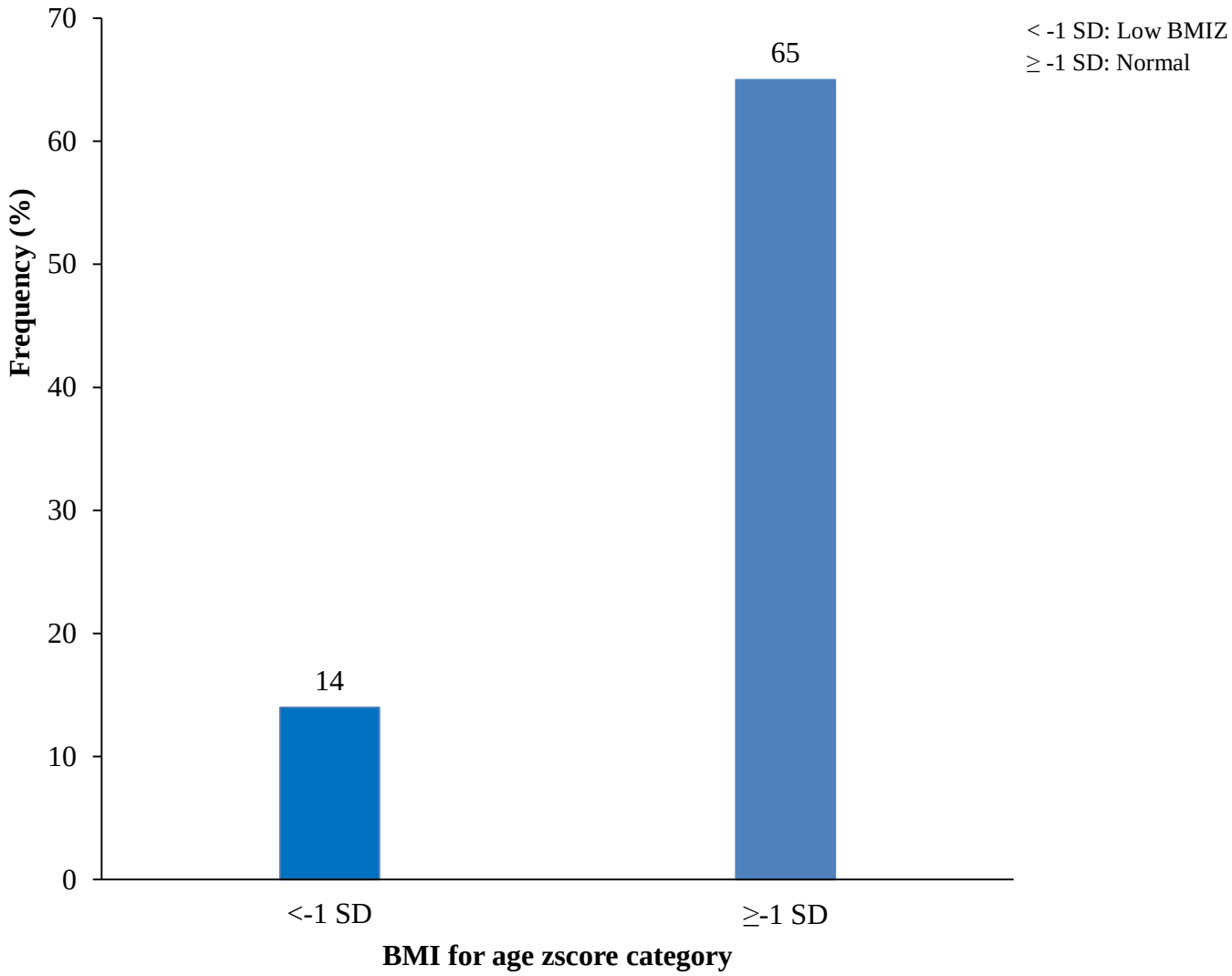
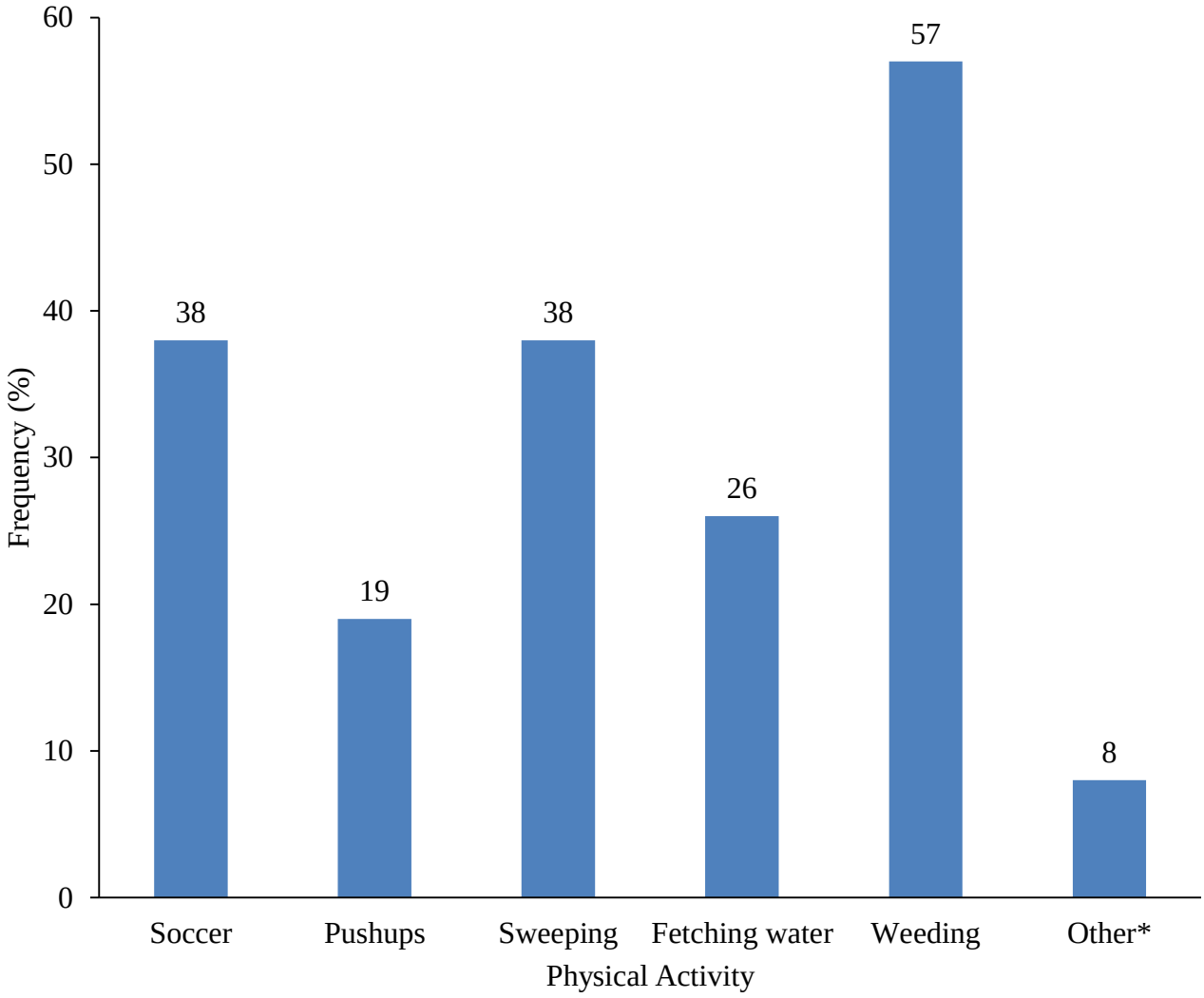


Figure 4.8: Number of inmates by BMI for age z-score

4.9 Main physical activities performed by Inmates

This figure shows the types of physical activity inmates engaged in. Weeding was the most predominant physical activity 57 (81.1%) followed by soccer 32 (45.6%) and sweeping 32 (45.6%). Other physical activities like ampe (jumping game played by girls), washing dishes were also performed by inmates



*Ampe, Basketball, Assisting in kitchen, Stomach exercise, Squatting, Washing of dishes
+Values are the number of inmates who reported performing physical activity

Figure 4.9: Main physical activities performed by Inmates+

4.10 Times inmates reportedly spent performing physical activity

Data from this table shows the duration of physical activity. Most of the inmates engaged in physical activities (soccer, sweeping, fetching water and weeding) between 30 minutes to an hour except for push-ups which lasted for less than 30 minutes.

Table 4.10: Times inmates reportedly spent performing physical activity (n=79)

	Time (mins/day)		
Variable	< 30mins n (%)	30 ≥ t < 60 n (%)	≥ 60 n (%)
Soccer	5 (13.2)	19 (50.0)	14 (36.8)
Pushups	11 (57.9)	6 (31.6)	2 (10.5)
Sweeping	16 (42.1)	21 (55.3)	1(2.6)
Fetching water	10 (38.5)	10 (38.5)	6 (23.0)
Weeding	5 (23.0)	42 (73.7)	10 (17.5)

4.11 Clinical symptoms of inmates

Pale conjuctiva, mottled enamel, spongy and bleeding gums, pellagrous dermatosis, bitot spot, angular stomatitis were some of the clinical signs observed. Pale conjuctiva was the major clinical symptom observed among the inmates while pellagrous dermatosis, bitot spot, angular stomatitis were the least observed.

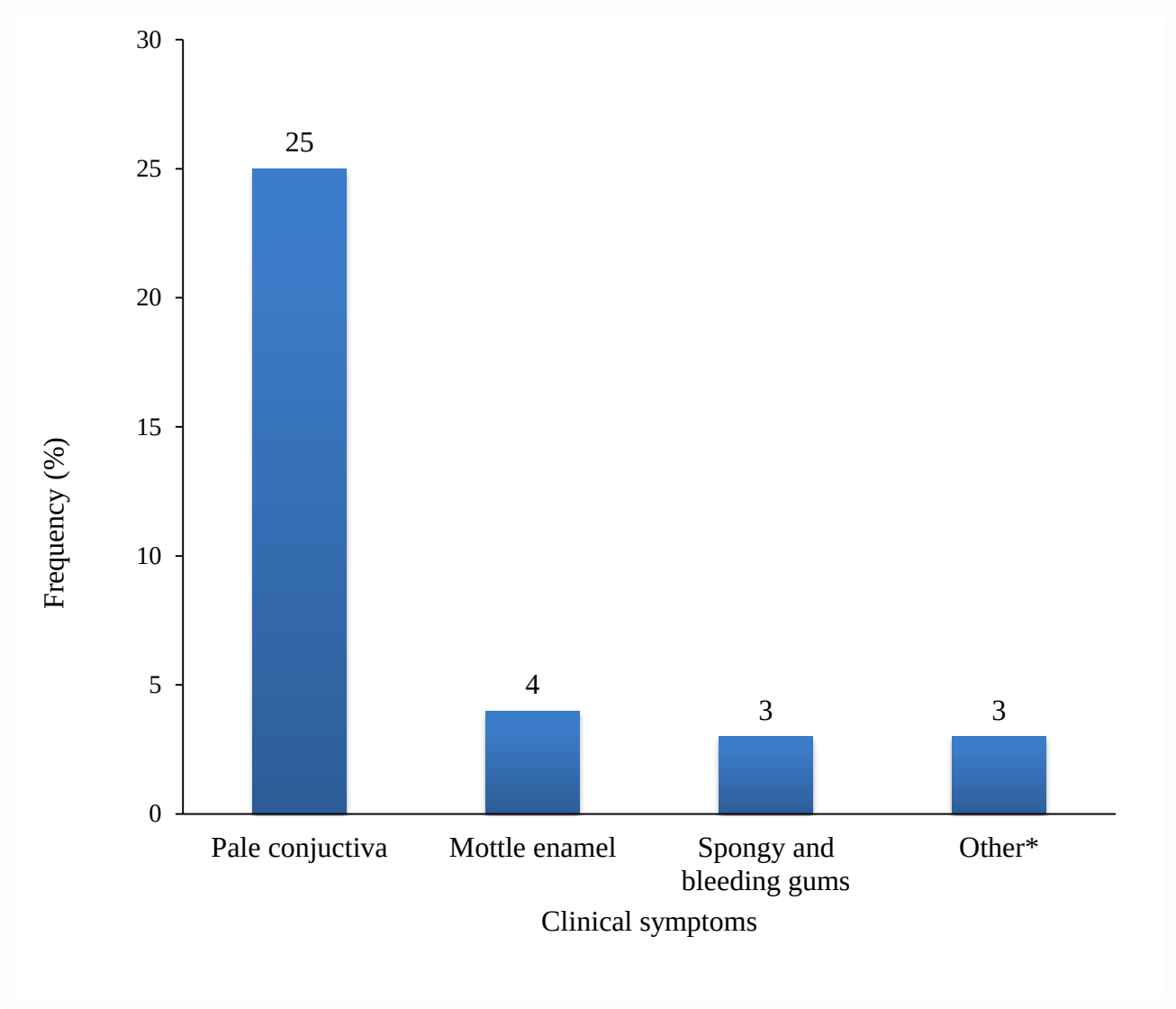


Figure 4.11: The physical appraisal of inmates with clinical symptoms

* Pellagrous dermatosis, Bitot spot, Angular Dermatosis

4.12: Blood pressure and pulse rate of inmates

Data in this table indicates the blood pressure and pulse rate of the inmates. The males recorded a mean systolic pressure of 120.19 ± 10.19 mmHg while the female recorded a mean systolic pressure of 104.50 ± 6.09mmHg. This trend was the same for the diastolic pressure. The mean pulse rate per minute for the males and females were 74.10 ± 9.27 min and 68.17 ± 6.97min respectively.

Table 4.12: Blood pressure and pulse rate of inmates (n=79)

Variable[+]	Male	Female	Overall
Systolic (mmHg)[*]	120.19 ± 10.19	104.50 ± 6.09	119 ± 11.06
Diastolic(mmHg)[*]	62.82 ± 8.69	59.17 ± 6.37	65.32 ± 8.69
Pulse Rate(bpm)[**]	74.10 ± 9.27	68.17 ± 6.97	73.1 ± 9.22

[+]Values are mean ± SD

*****Categorized based on the blood pressure table for adolescents less than 18 years from the fourth report on the diagnosis, evaluation and treatment of high blood pressure.
http//:www.nhlbi.nih.gov/health-pro/current/hypertention-pediatric-jnc-4/blood-pressure-table
Adolescents (18-19) years were categorized based using the blood pressure chart for adults
www.bloodpressureUK.org/bloodpressureandyou/the basic/blood pressure
** Categorized using the U.S National Library of Medicine, medical encyclopedia-Pulse
http://www.nlm.nih.gov/medlineplus/ency/article/003399.htm

4.13 Selection of variables for logistic regression

Table 4.13 shows the Pearson correlation coefficients (*r*) and *P* values from the correlation analysis between BMIZ and selected background variables. Significant negative associations were observed for sex, age, being at SBCC and illness in the month preceding the study. Significant positive association were observed for being at JGCC and average number of times they consumed food in a day. The length of stay at the institution and their avoidance of certain foods showed no significance when correlated with BMIZ.

Table 4.13: Correlation between BMI-age z score and potential covariate

Variable	r	p-value
Sex	-0.308	0.006
Age, (years)	-0.222	0.049
Institution		
JGCC	0.308	0.006
SBCC	-0.302	0.007
BHR	0.086	0.451
Illness in the past nth	-0.280	0.012
Length of stay	-0.078	0.470
Average number of times	0.315	0.005
Avoid eating certain foods	-0.098	0.392

SBCC- Senior Boys Correctional Centre
JGCC-Junior Girl Correctional Centre
BRH- Boys Remand House
** Correlation is significant at the 0.01 level (2-tailed).

Based on the results of the correlation analysis the following variables were selected for entry into the logistic regression to determine which factors were related to low BMIZ: age, sex, being at SBCC, avoidance of certain foods and their length of stay at the detention facility.

4.14 Factors related to low BMIZ

The logistic regression model revealed that the inmates' age, but not sex, average number of times they eat per day, illness in the month preceding the study, avoidance of certain foods, being at SBCC and their length of stay at the correctional facility was significantly related to low BMIZ. The odds of having a low BMIZ was 10-fold higher for inmates aged between 13-16 years compared to inmates who were between the ages of 17-19 (OR= 10.12, 95% CI= 1.08, 94.69, P= 0.042).

Table 4.14: Logistic regression showing the association between low BMIZ and other potential covariates

Variable	OR (95% Confidence interval)	P-value
Sex		
Male	1.82 (0.66, 49.67)	0.720
Female	1	
Age		
13-16	10.12 (1.08, 94.69)	0.042
17-19	1	
SBCC		
No	0.27 (0.02, 4.61)	0.365
Yes	1	
Avoidance eating certain food		
No	2.13 (0.37, 12.31)	0.398
Yes	1	
Length of stay		
1-12months	0.59 (0.88, 3.99)	0.591
> 12 months	1	

Variables were selected if they were significantly associated with BMI at 0.10 level of significance in a bivariate analysis (correlation).Odds ratio was obtained using binary logistic regression.

4.15 Key informant interview with officers-in-charge

Below is a summary of the key informant interview. The interview was based on funding, food security and storage facilities present at the institution.

4.15.1 Funding

An interview with the officers in charge at the correctional centres and remand home revealed that the central government was the main source of funding. Nonetheless JGCC and BRH receive additional funding from UNICEF to augment what the government gives. The Department of Social Welfare was the intermediary for the JGCC and BRH while the Ghana Prison Service was the intermediary for the SBCC and were contacted when they run out of money. The source of funding was regular for the running of the SBCC but irregular for the running of JGCC and the BRH. The estimated expenditure for daily feeding at the SBCC was GH₵ 1.8 per inmate which was not enough and had to rely on supplies from the station's farm. On the other hand, the estimated expenditure was GH₵ 5.0 per inmate (including donations quantified into cash) for their daily feeding at the JGCC and the BRH. They further added that the amount was not enough and had to call others for help or use their personal money.

4.15.2 Issues on food security in the last 12 months and storage facilities

Officers at the SBCC could afford balanced meals while the officers at the JGCC and BRH sometimes could not afford a balanced meal. Officers at these institutions stated that they never had to cut the size of their meals because of insufficient funds, and inmates did not eat less than they were supposed to. They also revealed that inmates never went hungry. The officers in charge at the SBCC disclosed that they never had food shortage, contrary to what happened at the JGCC

and the BRH, where they sometimes had food shortage of a particular kind which they substituted with what was available. This shortage was attributed to lack of funds. Food supplies to their store was by contractors as with the SBCC and purchases from the open market as with the JGCC and BRH. All the institutions received donations from churches, individuals and NGOs which were irregular. All the institutions had food stores, and deep freezers which were functional and effective. However, the deep freezers at JGCC were not enough.

CHAPTER FIVE

5.0 DISCUSSION

The purpose of the study was to assess the nutritional status of adolescent offenders in Accra. These individuals form a fairly small section of the general offenders in correctional facilities in Ghana. Due to the delicate nature of their growth and development and the many uncertainties about their nutritional status, their background characteristics, lifestyle, dietary pattern and intakes, anthropometric indicators and the physical appraisal were used as tools to understand this phenomenon.

5.1 Background characteristics of inmates

The demographic information of sex, age, former place of residence, length of stay at the correctional facility or remand home were key to understanding their background. The Ghana Prison Service annual report (2012) recorded that 98.3% of the average daily convicts population for the reporting year were males while the female convicts consisted 1.7% which underpins the fact that males engage in more risky behavior than females. The trend was consistent among the inmates in this study. The adolescent offenders were aged from 13-19, years with most of them being first time offenders. This affirmed the Ghana Prison Service annual report (2012) which suggested that more than 70% of convicts were first time offenders with their education mostly truncating at the primary level due to their lack of conformity to rules and regulations, family inability to cater for them, parental neglect and the search for greener pastures.

The UN Standard Minimum Rules for the Administration of the Juvenile justice “the Beijing rules” (1985) suggested that a child should not be deprived of his /her liberty unless convicted of an offence which is serious and violent. Most of the inmates were arrested for

engaging in serious and violent conduct with theft being the predominant amongst the inmates. Rapid urbanization and industrialization according to Soh (2012) contributes to some urban problems of which crime is one. In short, urban dwellers are more susceptible to engage in criminal acts than rural dwellers. The highly industrialized regions in Ghana, Greater Accra and the Ashanti regions, were the areas of residence for most of the inmates before their arrest. Most of the inmates engaged in social activity as a way of mingling with other inmates especially during clean ups, religious activities as well as durbars held. Nonetheless, some inmates sometimes showed antisocial behaviors and would not engage in any social activity. López and Elmer (2011) suggested that although most antisocial behavior are temporary and limited to a short period of time in adolescents, some adolescents may experience it for longer periods which explains why some did not engage in any kind of social activity.

Loneliness and depression are conditions that usually occur with inmates in correctional facilities. According to the Australian Bureau of Statistics ABS (2007), individuals aged from 18 to 24 years have the highest prevalence of mental disorders and the onset of depression typically occurs around mid-to-late adolescence of which symptoms include change in appetite or weight, affecting the nutritional status. Most inmates had experienced depression. One of the inmates said she sometimes felt so depressed that she wanted to take her life and would sometimes go a whole day without eating.

5.2 Dietary patterns of the inmates

Although the majority of the inmates had good appetite, some felt hungry sometimes or often contrary to what their officers in charge said. Some suggested that they avoided meals served them like koko, gari, banku, groundnut soup and palmnut soup. Videon and Manning (2003)

suggested that adolescent eating patterns are established through a complex process involving internal and external factors such as food preference and availability. Amnesty International (2012) reported that both staff and inmates complained of the poor quality of food. In this study, the officers were also of the same view but quickly added that the quality was better than that of food served to the adult prisoners. The study participants provided reasons why an inmate would skip a meal. These included the taste and appearance, the monotony of food, dislike of the accompaniment or having allergic reactions to the food. It was also observed that inmates who reported avoiding certain foods consumed them anyway. The UN Standard Minimum Rules for the Treatment of Prisoners (1955) state that "every prisoner shall be provided, by the administration, at the usual hours, with food of nutritional value adequate for health and strength or wholesome quality and well prepared and served". The Ghana Prison Service annual report (2012) stated that GH ₵1.80 was not enough to feed an inmate and hence pleaded with the government who is the main financier to increase their quota. Amnesty International (2012) in an interaction with officers reported that the budget for food was inadequate and that improved provision of food was necessary to assure prisoners the nutrition they require in order not to violate the right to food under Article 11.1 of the International Covenant on Economic, Social and Cultural Rights (ICESCR) (1966). In this study the managers of the institutions stated that the money for feeding was not enough and had to rely on other sources like donations to augment the problem. Owing to the fact that these adolescent offenders are still undergoing physiological changes, the inadequate source of nourishment may affect their growth potential as they grow into adults.

5.3 Dietary intake of the inmates

Inmates generally consumed food made available by the institution on daily basis, from breakfast to supper consistent with the UN Standard Minimum Rules for the Treatment of Prisoners (1955) and Section 35.1 of the Prisons Service Act (1972). Nonetheless, the already poor nature of the prison meals, as stated in Amnesty International Report (2012), the use of the food composition table to estimate the nutrient intake may not give a truer picture and hence the use of the analytical method.

Protein, carbohydrate and fat all contributed to the total energy obtained from the inmates' food. However it was observed that carbohydrates being the body's main source of dietary energy contributed significantly to their total caloric intake compared to protein and fat across the three institutions. A dietary recommendation by Story and Stang (2005) suggested that 50% or more of the daily calories should come from carbohydrate. In this study regardless of the method used, the percent contribution of carbohydrates was between 68.87 - 76.20 % which confirmed studies by Latham (1997) and Young and Gherardin (2008) who stated that in developing countries where poverty is endemic, carbohydrate provided 70 percent or more of their energy intake of the population in contrast to industrialized countries where it contributes about 45-50% of their energy intake. Howard (2012) affirmed this trend by stating that carbohydrates are the cheapest and readily available source of energy since it was easy to produce and can be obtained anywhere in the world in the form of stem tuber, cereal grains and legumes.

The Nutrient Adequacy Ratio (NAR) for carbohydrate, fat and Fe was met when analysed using the food composition table. On the other hand, using the analytical method, carbohydrate was the only nutrient that was met. Sinko *et al.* (1995) suggested that NAR greater than 1 meant that their requirement had been met. Nonetheless, if the NAR fell below 1, requirement may still

be met since the RDA is set at the mean requirement of 77% RDAs. Ca, Zn and Fe recorded at the JGCC fell further away from 1 suggesting a higher probability that their diet failed to meet the requirement for that nutrient using the standard analytical method. This study was consistent with a cross-sectional study conducted by Gould *et al*.(2013) in Papua New Guinea using 148 male prisoners revealed that prisoners were likely to be micronutrient deficient. The foods consumed during the survey period were either not rich or adequate in these minerals accounting for the low NAR values recorded by these minerals. It was also observed that the higher the quantity consumed the higher the nutrients they obtained. Even though the JGCC and the BHR ate from the same pot, their nutrient intake was dependent on the quantity they consumed. The caloric intake of males were also more than the females consistent with Story and Stang (2005) assertion except for inmates at the SBCC. Even though the inmates at the JGCC and BRH met their energy requirement, inmates at the SBCC did not meet half of their NAR when the FCT was used. This reduction in energy may result in a delay of the onset of puberty or growth retardation as suggested by Story and Stang (2005) and Soliman *et al.* (2014). Using the LPA, energy, Protein, Fat, Fe, Zn and Ca did not meet the NAR. Reduced intake of protein may result in the reduction of linear growth, delay in sexual maturation and reduced accumulation of lean body (Story and Stang, 2005). Skeletal growth may be poor if the intake of Ca is not improved. Consequently, poor development of bone mass will increase the risk for fractures and osteoporosis later in life (Story and Stang, 2005). Inadequate zinc intake will delay growth since it is required for cell division and protein synthesis.

The MAR using the FCT showed that their diet was adequate but using the LPA their requirement was not adequate. The values in the food composition table were based on the usual way the particular meal is prepared, literature values obtained from papers that focus on the

composition of the human food and data from industry (Berdanier *et al*. 2007). Food prepared and served in correctional facilities and remand homes may not meet that standard. Information from the key informant interview suggested that they relied on other sources of funding from benevolent organization, station's farm and individual this explains why there is a deficit in their nutrient intake because government funding was not enough.

5.4 Physical activity of the inmates

Generally, the study participants engaged one way or the other in a physical activity for different durations. Weeding, fetching water and sweeping were some of the physical activities performed by the inmates. Physical activity helps reduce the risk of developing chronic disease and in view of this the managers of the correctional institution and the remand home intentionally incorporated games as stipulated by Møller *et al.* (2007) and Rule 21(1, 2) of the UN Standard Minimum Rules for the Treatment of Prisoners (1955) to promote health and reduce the feeling of depression, anxiety and improve their psychological well-being as stated by the US Department of Health and Human Service, (2010). Majority of the activities performed by the inmates lasted between 30 minutes to less than an hour which was in line with the ACSM (2007) guideline which recommend either 30min of moderate-intensity exercise on 5 days/week or 20 minutes of vigorous-intensity exercise on 3 days/ week.

5.5 Anthropometric measurements of the inmates

Anthropometric measurements, as stated by Basai *et al.* (2012), are a common tool used to assess the nutritional status among children and adolescents. Findings from this study revealed on an average that both male and female had a normal BMI. However, after classifying them using

the WHO BMI classification, less than 20% of the inmates had a low BMIZ. This percentage can be attributed to the low quality of food consumed. Nyasulu *et al*. (2015) asserted that low BMI could occur due to the presence of an infection. Majority of the inmates had a normal BMI to age z-score (> -1SD). Having a normal BMI does not necessarily mean that one's nutritional status is right. Bhurosy and Jeewon (2013) suggested that there are BMI pit falls using BMI as an assessment tool since it does not involve ethnicity-based cut-off tailored for specific population. An increase in BMI could be due to irregular eating and meal skipping, which according to Huang (2010) in a study in Taiwan, stated that the odds of developing obesity was 1.34 controlling for its co-variates. A prospective cohort study by Niemeier *et al*. (2006) of 9919 adolescent and adults aged between 11 and 27 showed that a decrease in breakfast consumption and skipping breakfasts can predict an increase in BMI.

5.6 Clinical assessment of inmates

Pale conjuctiva, mottled enamel, spongy and bleeding gums were some of the clinical signs observed. Majority of the inmates who showed some clinical signs had pale conjuctiva which is suggestive of iron deficiency anaemia. The lack of sufficient Fe in diet could account for this as seen in Table 4.6. The Ghana Prison Service annual report (2012) and (2013) revealed that anaemia was the most predominate cause of death. A study conducted by Kaur and Kaur (2011) among 50 males and 50 females in a government secondary school in India revealed that study participants who showed low iron level had pale conjuctiva. Mottled enamel may be due to excessive fluoride in their drinking water. Gupta *et al*. (2014) suggested that continuous high intake of fluorine in water will lead to mottled enamel. Vitamin C deficiency might have led to the spongy and bleeding gums. On the average both the diastolic and systolic pressure were normal as

stated in the blood pressure tables for adolescents less than 18 years from The Fourth Report on the diagnosis, evaluation treatment of high blood pressure and blood pressure chart for adolescents aged 18-19 (2015). Pulse rates were also normal as according to the US National library of medicine (2015).

5.7 Association between low BMIZ and its covariates

The logistic regress revealed that even though sex (r= -0.318, 0.006), age (r= -0.222, P =0.049), being at JGCC (r= 0.308, P =0.006), being at SBCC (-0.302, P =0.007) illness in the preceding month (r = -0.280, P= 0.012) and the average number of times the inmates ate (r= 0.315, P=0.005) were correlated with low BMIZ, only age was a significant predictor of low BMIZ (OR= 10.12; 95% CI=1.57, 25.11, P= 0.042). The odds of having a low BMIZ was 10 fold higher for inmates aged between 13-16 years compared to inmates who were between the ages of 17-19. Adolescents in their early stages are susceptible to malnutrition since it is a period where growth spurt commences. For some changes to occur as suggested by Shalitin and Philip, (2003), Jones and Lopez, (2013) and Shirtcliff *et al.* (2009), a threshold of nutrients is needed to be reached and hence a decline in their nutrient intake will lead to malnutrition. Sawyer *et al.* (2012), Giedd (2008) and Keating (2004) suggested that the cerebellum and the frontal lobes which are involved in the high function of the brain, like making moral judgement, solving problems and planning, undergo rapid development of synaptic connections around the onset of puberty (10-12) in a process called exuberance. Nutritional insufficiencies of energy, fat, iron, zinc, copper, iodine, selenium, vitamin A, choline and folate make rapid development more vulnerable. The odds of having a low BMIZ was 82% higher in male compared to the females but was not significant. Female inmates, who represented a minority of inmates, are treated with care compared to the males and might have led

to this outcome. The period of adolescence are in two parts, early (10-14 years) and late (15-19 years) adolescence. The odds of having low BMIZ was 73% lower for inmates who were not at the SBCC compared to inmates at the JGCC and BRH. Amnesty international (2012) and the Ghana Prison Service Annual Report (2012) all suggested that food consumed in the Centre was inadequate meaning that the inmates' nutrient intake may be affected leading to malnutrition especially for adolescents who require a nutritious meal.

5.8 Limitations to the study

These findings should however be interpreted with some level of caution, for example, the use of cross-sectional design establishes associations and not causality. Biochemical analysis was not done due to the prison rule that states that no invasive method should not be meted on inmates. Food samples were not allowed to be taken from the SBCC.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

- Weeding as a physical activity was performed by more inmates than any other physical activity and was followed by sweeping and soccer. About 74% of the inmates spent between 30 min and 1 hour performing this activity
- Majority of inmates avoided koko, banku, palm nut soup, gari and groundnut soup but had good appetite.
- The adequacy of nutrient intakes of inmates depends on the method used to determine the nutrient intakes. Analysis of their dietary intake using the FCT showed a possible overestimation of their nutrient intake when compared to that obtained from LPA.
- Majority of inmates had a normal BMI-for-age z score
- Pale conjuctiva was the most predominant clinical sign suggestive of severe anaemia. On the average inmates had a normal blood pressure reading.
- Age was the only independent significant predictor of low BMIZ malnutrition amongst the inmates.

In view of this, the nutritional status of the adolescent offenders in Accra are not up to standard hence interventions may be required to improve this situation.

6.2 Recommendations for further studies

Further works need to be done in this area in order to explain nutritional status of incarcerated inmates. We therefore recommend the following:

- Establishment of longitudinal study in Ghana to monitor the nutritional situation of inmates as they enter the Centre through till they leave.
- Biochemical assessment as a tool in understanding their nutritional status.
- Assessment of other nutrients like vitamins and other minerals of public health importance to this vulnerable group

Based on the results obtained from their dietary intake, we would like to add our voice to that of the Ghana Prison Service and Amnesty international for government to increase the cost of feeding per day per inmate and also the prompt release of government subvention to improve their nutritional status. There is therefore the need to continue engaging cooperate institutions as part of their corporate social responsibilities to help these institution. There is also the need to increase investment into skill training like carpentry, shoemaking and dressmaking among others in the institution in order to generate funds internally to support the running of the institution.

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APPENDICES

Appendix 1: Ethical Clearance

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH
Established 1979 *A Constituent of the College of Health Sciences*
University of Ghana
INSTITUTIONAL REVIEW BOARD

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My Ref. No: DF.22
Your Ref. No:

6th May, 2015

ETHICAL CLEARANCE

FEDERALWIDE ASSURANCE FWA 00001824 **IRB 00001276**

NMIMR-IRB CPN 020714-15 *amend.* 2015 **0000908 IORG**

On 6th May 2015, the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (IRB) at a full board meeting conducted continuing review and amended your protocol titled:

TITLE OF PROTOCOL : Nutritional Status of Adolescent offenders in Accra

PRINCIPAL INVESTIGATOR : Richard Stephen Ansong, MPhil Cand.

Please note that a final review report must be submitted to the Board at the completion of the study. Your research records may be audited at any time during or after the implementation.

Any modification of this research project must be submitted to the IRB for review and approval prior to implementation.

Please report all serious adverse events related to this study to NMIMR-IRB within seven days verbally and fourteen day s in writing.

This certificate is valid till 5th May, 20 16. You are to submit annual reports for continuing review.

Signature of Chair: ..... For

Mrs. Chris Dadzie
(NMIMR-IRB,Chair)

cc: Professor Kwadwo Koram
Director, Noguchi Memorial Institute
for Medical Research, University of Ghana, legon

Appendix 2: Questionnaire for inmates

UNIVERSITY OF GHANA

DEPARTMENT OF NUTRITION AND FOOD SCIENCE

QUESTIONNAIRE

The Nutrition situation of Adolescent offenders in Accra

Date: …….. **Form (A) no.: ……..**

A. Background

1. Age of Child AGE

a. 10 -14 [ ] b. 15- 19 [ ]

2. Level of Education LOE

a. Never [ ] b. Primary [ ] c. JHS [ ] d. SHS [ ] e. Other……

3. Length of stay in the correction center LOS

…….

4. Religion of the inmate REL

a. Christian [ ] b. Muslim [ ] c. traditional [ ] d. Other [ ]

5. Former place of stay FPS

……

6. Occupation of guardian OCC

……..

7. Crime committed CC

……

8. Number of times at the Correctional Centre NOT

a. First time [ ] b. Second time [ ] c. More than twice [ ]

9. Do you take part in any social activity? SOA

a. Never [ ] b. Sometimes [ ] c. Often [ ]

10. Do you feel lonely? FELY

a. Never [ ] b. Sometimes [ ] c. Often [ ]

11. Have you suffered from any illness in the past 1 month? IPOM

A. Yes [ ] b. No [ ]

12. If yes specify: ……

13. Did you take any kind of medication for the condition? AKM

A. Yes [ ] b. No [ ]

14. If yes specify: ……

B. Dietary information

15. What is your appetite APP

a. Good [ ] b. Fair [ ] c. Poor [ ]

16. Do you often feel hungry? OFH

a. Never [ ] b. Sometimes [ ] c. often [ ]

17. Do you avoid eating certain food? AECF

a. Yes [ ] b. No [ ]

18. If yes what foods WFS

Specify ……

19. Reason RSN

……

20. How many times on average, do you eat in a day? AVT

a. 1-2 [ ] b. 3-4 [ ] c. more than 4 times

21. Do you have regular times of the day for eating? RTE

a. Yes [ ] b. No [ ]

22. Which meal(s) do you usually skip? MUS

a. Breakfast [ ] b. Lunch [ ] c. Supper [ ] d. none [ ]

23. Why? WHY

Please specify_____

24. Do you usually eat snacks? ESKS

a. Yes [ ] b. No [ ]

25. If yes, what type of snacks do you take usually take? WSKS

a. Sweets [ ] b. Savories [ ]

26. And what time of the day do you usually eat them? WTD

a. Morning [ ] b. Afternoon [ ] c. Evening [ ]

27. How often do you receive food outside the dining the dining hall? RFOT

a. Never b. Daily c. Once a week d. 2-3 times week e. 3-4 times week

C. Dietary intake information and Physical Activity

Please tick in the appropriate columns on the following table to show what foods from the different groups have been eaten in the past five days and how often.

Daily weighed Food intake

Meals time	**Dish**	**Weight of bowl**	**Weight of bowl + food**	**Weight of bowl + left over**	**Food consumed**
Breakfast					
Snack					

Meals time	Dish	Weight of bowl	Weight of bowl + food	Weight of bowl + left over	Food consumed
Lunch					
Snack					
Evening					
Snack					

D. Physical Activity

1. Do you engage in any physical activity? EPA
a. Yes [ ] b. No [ ]

2. If yes IYES

Specify…….

3. Duration of activity DOA

a. less than 30min b. 30min – less than 1hour c. more than 1 hour

4. Type of Activity TOD

a. soccer [ ] b. brisk walking [ ] c. weeding / sweeping [ ] d. Other ……...

E. Anthropometry

Variables	Reading		Average	Code
Weight (kg)	**1**	**2**		WGT
Height (m)				HGT
BMI (kg/m^2)				BMI
Percentage body fat				PBF

F. Clinical assessment

Skin	**Present**	**Absent**	**CODE**
Xerosis			XRSIS
Pellagrous dermatosis			PEDS
Flaky paint dermatosis			FLPDS
Oedema			ODA
Eyes			
Bitot Spots			BTS
Pale conjunctiva			PCA
Keratomalacia			KEMA
Hair			
Lack of lustre			LOL
Thinness of sparseness			TOS
Dispigmentation			DPN
Easy Pluckability			EPY
Teeth, gums and Tongue			
Mottled enamel			MEL
Spongy and bleeding			SNB
Glossities			GST
Reddish tongue			RDT
Lips			
Angular Stomatitis			ANSS
Chelosis			CLS
Thyroid glands			
Visible goiter			VGR
Palpable goiter			PPE

Blood pressure

Variables	**Readings**		
	1	**2**	**Mean**
Systolic			
Diastolic			

Appendix 3: Questionnaire – Officers in Charge

UNIVERSITY OF GHANA

DEPARTMENT OF NUTRITION AND FOOD SCIENCE

The Nutrition situation of Adolescent offenders in Accra

Financial status, food availability and storage facility assessment

(To be filled by the officers in charge)

Date: …… **Form (B): ……..**

A. Financial status

1. What are your main sources of funding?

……
……
……
……
……
……
……
……

2. Is the source regular?

a. Yes [ ] b. No [ ] c. Unpredictable [ ]

3. When you run out of money, who do you contact and what is the response(s) often?

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4. What percentage of the total fund given is used for feeding?

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5. What is the estimated expenditure on food a day per day?

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6. Is the amount enough?

a. Yes [ ] b. No [ ]

7. If no how do you manage?

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B. Food security

These next questions are about the food eaten by the inmates in the last 12 months and whether you were able to afford the food they needed.

8. The food that (you) bought just didn't last and (we) didn't have money to get more. Was that often true, sometimes true, or never true for (you/your household) in the last 12 months?
[1] Often true [ ]
[2] Sometimes true [ ]

[3] Never true [ ]

9. You couldn't afford to provide the inmates balanced meals. Was that often, sometimes, or never true for in the last 12 months?
[1] Often true [ ]
[2] Sometimes true [ ]
[3] Never true [ ]

10 Did you ever cut the size of meals or skip meals of the inmates because there wasn't enough money for food in last 12 months?
[1] Often true [ ]
[2] Sometimes true [ ]
[3] Never true [ ]

Optional screener: if any of the first 3 questions are answered affirmatively (ie., if either **Q 8** or **Q9** are often true or sometimes true or **Q10** is yes) proceed to the next question. Otherwise skip to end **(Q13).**

11. **[Ask only if Q10=YES].** How often did this happen -almost every month, some months but not every month, or in only 1 or 2 months?
[1] Almost every month [ ]
[2] Some months but not every month [ ]
[3] Only 1 or 2 months [ ]

12. In the last 12 months, did they ever eat less than you felt they should because there wasn't enough money to buy food?
[1] Often true [ ]
[2] Sometimes true [ ]
[3] Never true [ ]

13. In the last 12 months were they ever hungry but didn't eat because you couldn't afford enough food
[1] Often true [ ]
[2] Sometimes true [ ]
[3] Never true [ ]

14. How often do you have food shortage?

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15. What do you think is the cause of this shortage?

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16. Where and how do you get your food supplies to your store?

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17. What storage facilities do you have?

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18. Are these facilities effective and functional?

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19. Do you get assistance in kind or cash for churches and other benevolent organisation?

a. Yes [ ] b. No [ ]

20. If yes, can you comment on the type of donors and how often you get these donations in a month?

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Any other comments

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……

Appendix 4: Child assent form

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH INSTITUTIONAL REVIEW BOARD (NMIMR-IRB)

CHILD ASSENT FORM

Introduction

My name is Richard Stephen Ansong and I am from the nutrition and food Science department at University of Ghana. I am conducting a research study entitled nutrition situation of Adolescent offenders in Accra. I am asking you to take part in this research study because I am trying to learn more about the nutritional situation of adolescent offenders in Accra. This will take Six months.

General Information

If you agree to be in this study, you will be asked to if you accept to participate in this research study, body measurements such as height, weight and total body fat composition would be taken and also you will be asked to provide certain information such as age, level of education etc. Dietary and clinical assessment will also be carried out. None of this information will bear your name.

Possible Benefits

Your participation in this study will let you know your nutritional status and also provide the impetus for policy makers to plan programmes for inmates at the Centre. You will be given a bowl, cup and a pair of bathroom slippers for your time and participation.

Possible Risks and Discomforts

However, the risks associated are the inconvenience you may experience is the time you would have to spend to complete the questionnaire. Possibly some of the questions may make you feel uncomfortable or lead to a loss of your privacy. You are not compelled to answer the entire questionnaire or to complete the interview if you so wish.

Voluntary Participation and Right to Leave the Research

You can stop participating at any time if you feel uncomfortable. No one will be angry with you if you do not want to participate.

Confidentiality

Your information will be kept confidential. No one will be able to know how you responded to the questions and your information will be anonymous.

Contacts for Additional Information

You may ask me any questions about this study. You can call me at any time on 0541260704 or 0508306703] or talk to me the next time you see me.

Please talk about this study with your parents before you decide whether or not to participate. I will also ask permission from your parents before you are enrolled into the study. Even if your parents say "yes" you can still decide not to participate.

Your rights as a Participant

This research has been reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB). If you have any questions about your rights as a research

participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email addresses: nirb@noguchi.mimcom.org

VOLUNTARY AGREEMENT

By making a mark or thumb printing below, it means that you understand and know the issues concerning this research study. If you do not want to participate in this study, please do not sign this assent form. You and your parents will be given a copy of this form after you have signed it.

This assent form which describes the benefits, risks and procedures for the research titled nutrition situation of adolescent offenders in Accra has been read and or explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate.

Child's Name: …… **Researcher's Name: ……**

Child's Mark/Thumbprint…… **Researcher's Signature: ……**

Date: …… **Date:** ……

Appendix 5: Consent form

NMIMR-IRB CONSENT FORM

STUDY TITLE: The Nutrition situation of Adolescent offenders in Accra

PRINCIPAL INVESTIGATOR: Richard Stephen Ansong

ADDRESS: Department of Nutrition and Food Science, University of Ghana, Legon, Accra.

GENERAL INFORMATION ABOUT RESEARCH

INVITATION TO PARTICIPATE: This research study seeks to find out the Nutrition situation of adolescent offenders in Accra. I kindly invite you to participate in this study.

PURPOSE: Several works have been done on adolescents in Ghana, however, the nutritional situation of the adolescents at the correctional centre has received little work attention. Nutrient needs are greatest during this period and are influenced by events of puberty and simultaneous growth spurt. Understanding the true lifestyle and nutrition situation is key to planning appropriate intervention programmes for inmates. Findings from this formative research will support advocacy towards policy on nutrition for the adolescent in Correctional Centres as well as also inform other researchers and institution in planning programmes for similar groups elsewhere.

DESCRIPTION OF PROCEDURES: If you accept to participate in this research study, body measurements such as height, weight and total body fat composition would be taken and also you will be asked to provide certain information such as age, level of education etc. Dietary and clinical assessment will also be carried out. None of this information will bear your name.

ELIGIBILITY: This study will include all inmates who have spent a minimum of 4 weeks at the Centre and officers who are willing to participate in the study**.** Participants to be recruited for the study must meet the WHO age cut-offs for adolescence i.e. 10 -19 years.

POSSIBLE RISKS AND DISCOMFORT: The inconvenience you may experience is the time you would have to spend to complete the questionnaire. Possibly some of the questions may make you feel uncomfortable or lead to a loss of your privacy. You are not compelled to answer the entire questionnaire or to complete the interview if you wish to.

POSSIBLE BENEFITS: The outcome of the study will let you know your nutritional status status and also provide the impetus for policy makers to plan educational programmes for inmates at the correctional centre.

ECONOMIC CONSIDERATIONS: Participation does not require any payment from you. If you choose to participate, researchers will interact with you.

CONFIDENTIALITY: Any information obtained from your participation will be kept strictly confidential. Your consent form will kept separate from the data. The data will not be available to anyone other than the researcher. The information may be used in presentations and/or research papers. However, your name will never be used in any presentations, papers or reports.

Occasionally the Institutional Review Board (IRB) of Noguchi Memorial Institute for Medical Research may inspect study records as part of its auditing program, but these reviews will only focus on the researcher and not on your responses or involvement. The IRB is a group of people that reviews research studies to make sure they are safe for participants.

COMPENSATION: You will be given a bowl, cup and a pair of bathroom slippers for your time and participation.

VOLUNTARY PARTICIPATION: Participation in this study is not compulsory. You are free to opt out at any point in time if you so wish. You will not be penalized for deciding to quit.

QUESTIONS: Kindly take enough time to make a decision. All your questions about the study are always welcome. For further information concerning your participation in this study you can contact my supervisor Prof. Matilda Steiner- Asiedu on 0541260704 or Principal Investigator, Richard Stephen Ansong on 0508306703.

YOUR RIGHT AS A PARTICIPANT: This research has been reviewed and approved by the institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB).If you have any questions about your rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email address:nirb@noguchi.mimcom.org or HBaidoo@noguchi.mimcom.org

VOLUNTEER AGREEMENT: The above document describing the benefits, risks and procedures for the research on the nutrition situation of adolescent offenders in Accra has been read and explained to me. I have been given the opportunity to ask any questions concerning my participation in the research and answers have been given to my satisfaction. I agree to participate as a volunteer.

…… ……..

DATE SIGNATURE OR MARK OF VOLUNTEER

IF VOLUNTEERS CANNOT READ THE FORM THEMSELVES, A WITNESS MUST SIGN HERE:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

…… ……

DATE SIGNATURE OF WITNESS

I certify that the nature and purpose of the potential benefits and possible risks associated with participating in this study research has been explained to the above individual.

…… ……

DATE THUMBPRINT OF PERSON WHO OBTAINED CONSENT