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Nutritional Assessment and Eating Habit of Polytechnic Students: A Four Day Dietary Assessment of Energy and Nutrients

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Abstract: *Carbohydrates, proteins, and fats are essential macronutrients that play critical roles in energy provision, growth, metabolic regulation, and overall health. This study assessed the energy, macronutrient, and micronutrient intakes of a student population and compared observed intakes with Dietary Reference Values (DRVs) to identify potential nutritional adequacy or imbalance. Dietary intake data were analyzed using standardized nutrient composition software, and one-sample statistical tests were applied to evaluate differences between mean intakes and recommended values. The findings revealed that average energy intake was lower than estimated average requirements, largely due to reduced carbohydrate and fat consumption, potentially reflecting meal skipping and academic workload. Carbohydrate intake varied, with most respondents exceeding DRVs, while one sample indicated insufficient intake, raising concerns about fatigue and ketosis risk. Protein intake significantly exceeded DRVs, suggesting adequate essential amino acid availability but highlighting the need for balanced macronutrient distribution. Total fat and saturated fat intakes were significantly below maximum DRVs, which may reduce cardiovascular risk but could impair absorption of fat-soluble vitamins. Micronutrient analysis showed significantly low intakes of vitamin A and non-starch polysaccharides (NSP), indicating potential risks for visual impairment, immune dysfunction, and gastrointestinal disorders. In contrast, vitamin C intake was significantly higher than DRVs, likely due to high fruit and juice consumption, with possible implications for dental health. Iron, calcium, thiamine, and sodium intakes were generally adequate and did not differ significantly from DRVs. Alcohol intake was negligible across the population. Overall, the study highlights a pattern of imbalanced dietary intake, characterized by insufficient energy, fiber, and vitamin A alongside excessive protein and vitamin C consumption. These findings underscore the need for targeted nutrition education interventions to promote balanced dietary practices among students. Despite limitations related to short study duration, self-reported intake, and small sample size, the results provide valuable insight into student dietary behaviors and nutritional risks.*

Keywords: Dietary intake; Macronutrients; Micronutrients; Dietary Reference Values; Student nutrition; Energy intake.

INTRODUCTION

Nutrition is the science that interprets the interaction of nutrients and other substances in food (e.g. phytonutrients, antocyannins, tannins, etc.) in relation to maintenance, growth, reproduction, health and disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism and excretion. Human nutrition refers to the provision of essential nutrients necessary to support human life and health.

Nutritional status is the sum total of an individual's anthropometric indices as influenced by intake and utilization of nutrients, which is determined from information obtained by physical, biochemical, and dietary studies. It is a result of interrelated factors influenced by quality and quantity of food consumed and the physical health of the individual. An adolescents' nutritional status has important implications for his health, development of several chronic diseases, and plays a key role in breaking the cycle of malnutrition. The transition from adolescence to adulthood is an important period for establishing behavioral patterns that affect long-term health and chronic disease risk. University students seem to be the most affected by this nutritional transition (Meg *et al.,* 2012).

A diet is central to determining nutritional well-being and weight management. Diet quality refers to the degree to which food intake aligns with recommended dietary guidelines. Yahia *et al.,* (2016) found that while most students reported "satisfactory" dietary habits, only 52% met minimum recommendations for fruits and vegetables. This discrepancy between perceived and actual adequacy highlights the limitations of self-evaluation in dietary behavior. El Ansari, *et al*., (2015) demonstrated that adherence to dietary guidelines positively correlated with students perceived health and vitality. Conversely, inadequate diets contribute to micronutrient deficiencies that compromise cognitive function and immunity (Burrows *et al.,* 2017).

A poor diet may have an injurious impact on health, causing deficiency diseases such as blindness, anemia, scurvy, preterm birth, still birth and cretinism, health-threatening conditions like obesity and metabolic syndrome and such common chronic system disease as cardiovascular disease, diabetes, and osteoporosis. A poor diet can cause the wasting of kwashiorkor in acute cases, and the stunting of marasmus in chronic cases of malnutrition.

A healthy diet is a big part of any successful self-care plan. Nutrition has been linked with emotional, physical, and cognitive health. Eating a healthy diet gives the brain and bodies the vitamins and minerals needed to stay well. However, healthy eating habits can be difficult to maintain, especially if there is a mental disorder. Diet affects the brain neurochemistry that controls mood and response to stress, the way the brain and body interact, and the higher brain functions that control learning, memory and intellectual functioning (Baldini *et al.,* 2009; Wickramasinghe *et al.,* 2004).

Eating habits among students are influenced by multiple behavioral, social, and environmental factors. Meal skipping, irregular eating schedules, and frequent snacking are common patterns among young students, many skipped breakfasts regularly, and thereby citing lack of time as the major cause. Breakfast omission/irregular eating pattern is associated with lower academic performance and reduced metabolic efficiency. Economic constraints and food unavailability further shape eating habits thereby forcing Nigerian students to substitute proper meals with low-cost street foods such as pastries and instant noodles. These foods, though convenient, are high in sodium and trans fats, contributing to overweight and cardiovascular risk or, these habits tend to reinforce a negative dietary practice.

Making smart nutritional choices can be very important for optimal well-being and academic performance. There are many actions that college students can take to eat in a healthful way and enjoy their college years without jeopardizing their health from excessive weight gain or weight loss. University and Polytechnic students represent a unique demographic group with distinct nutritional demands due to their physical, cognitive, and psychosocial development. Adequate nutrient intake is essential to sustain the mental alertness, concentration, and immunity required for academic performance.

According to Salama and Esmail (2018), nutrition education directly improves students' understanding of nutrient balance, leading to better food choices and body weight regulation. Most students from tertiary institutions recognized the importance of nutrition, less than half practiced consistent meal planning. Hence, research study tends to analyze the documented food and drink consumed by a group of fifteen (15) male and fifteen (15) female Polytechnic students for a period of three (3) working days and one (1) weekend day, in which data was converted to energy and nutrients using a micro diet software.

The aim of the study was to collect data of food and drink and translate the information into nutrients and energy using computerized technique software called Microdiet and commenting on the results by comparing them with Dietary Reference Values.

LITERATURE/THEORETICAL UNDERPINNING

Nutritional Assessment

Nutritional assessment procedures were first used in surveys designed to describe the nutritional status of populations on a national basis. The assessment methods used were initially described following a conference held in 1932 by the Health Organization of the League of Nations. In 1955, the Interdepartmental Committee on Nutrition for National Defense (ICNND) was organized to assist low-income countries in assessing the nutritional status of their populations and to identify problems of malnutrition and the ways in which they could be solved. The ICNND teams conducted medical nutrition surveys in 24 countries. A comprehensive manual was then produced and later, updated guidance issued (ICNND, 1984) with the intention of standardizing both the assessment methods used for the collection of nutrition survey data and the interpretation of the results (Gibson, 2025).

On the recommendation of a World Health Organization (WHO) Expert Committee on Medical assessment of Nutritional Status, a second publication was prepared by Jelliffe (1966) in consultation with 25 specialists from various countries. This monograph was directed specifically at the assessment of the nutritional status of vulnerable groups in low-income countries of the world. Many of the methods described are still used by the U.S. Demographic and Health Surveys (DHS) Program to collect representative data on population, health, HIV, and nutrition, and about 30 indicators supporting the Sustainable Development Goals. The data are used to identify public health nutrition problems so that effective intervention programs can be designed. The U.S. DHS program has conducted more than 400 surveys in over 90 low- and middle-income countries since 1984 (Gibson, 2025).

Many higher income countries collect national data on the nutritional status of the population, some (e.g., the U.S. and the U.K.) collecting data on an ongoing basis using nutrition surveillance systems. In the past, these systems have often targeted high-risk populations, especially low-income mothers, children under five, and pregnant women. Now, with the growing awareness of the role of nutrition as a risk factor for chronic diseases, surveillance systems often encompass all age groups (Gibson, 2025).

Nutritional assessment systems

Nutritional assessment systems involve the interpretation of information from dietary and nutritional biomarkers, and anthropometric and clinical studies. The information is used to determine the nutritional status of individuals or population groups as influenced by the intake and utilization of dietary substances and nutrients required to support growth, repair, and maintenance of the body as a whole or in any of its parts**.** Nutritional assessment systems can take one of four forms: surveys, surveillance, screening, or interventions. These are described briefly below (Gibson, 2025).

Nutrition surveys

The nutritional status of a selected population group is often assessed by means of a cross-sectional survey. The survey may either establish baseline nutritional data or ascertain the overall nutritional status of the population. Cross-sectional nutrition surveys can be used to examine associations, and to identify and describe population subgroups "at risk" for chronic malnutrition. Causal relationships cannot be established from cross-sectional surveys because whether the exposure precedes or follows the effect is unknown. They are also unlikely to identify acute malnutrition because all the measurements are taken on a single occasion or within a short time period with no follow-up. Nevertheless, information on prevalence, defined as the proportion who have a condition or disease at one-time point, can be obtained from cross-sectional surveys for use by health planners. Cross-sectional surveys are also a necessary and frequent first step in subsequent investigations into the causes of malnutrition or disease.

National cross-sectional nutrition surveys generate valuable information on the prevalence of existing health and nutritional problems in a country that can be used both to allocate resources to those population subgroups in need, and to formulate policies to improve the overall nutrition of the population. They are also sometimes used to evaluate nutrition interventions by collecting baseline data before, and at the end of a nutrition intervention program, even though such a design is weak as the change may be attributable to some other factor. Several large-scale national nutrition surveys have been conducted in industrialized countries during the last decade. They include surveys in the United States, the United Kingdom, Ireland, New Zealand, and Australia. More than 400 Demographic and Health Surveys (DHS) in over 90 low- and middle-income countries have also been completed (Gibson, 2025).

Nutrition surveillance

The characteristic feature of surveillance is the continuous monitoring of the nutritional status of selected population groups. Surveillance studies therefore differ from nutrition surveys because the data are collected, analyzed, and utilized over an extended period of time. Sometimes, the surveillance only involves specific at-risk subgroups, identified in earlier nutrition surveys.

Surveillance studies, unlike cross-sectional nutrition surveys, can also identify the possible causes of both chronic and acute malnutrition and, hence, can be used to formulate and initiate intervention measures at either the population or the subpopulation level. In the United States, a comprehensive program of national nutrition surveillance, known as the National Health and Nutrition Examination Survey (NHANES), has been conducted since 1959. Data on anthropometry, demographic and socio-economic status, dietary and health-related measures are collected. In 2008, the United Kingdom began the National Diet and Nutrition Survey Rolling Program. This is a continuous program of field work designed to assess the diet, nutrient intake, and nutritional status of the general population aged 1.5 years and over living in private households in the U.K. WHO has provided some countries with surveillance systems so that they can monitor changes in the global targets to reduce the high burden of disease associated with malnutrition. Note that the term "nutrition monitoring," rather than nutrition surveillance, is often used when the participants selected are high-risk individuals (e.g., food-insecure households, pregnant women). For example, because house- hold food insecurity is of increasing public health concern, even in high income countries such as the U.S. and Canada, food insecurity is regularly monitored in these countries using the Household Food Security Survey Module (HFSSM) (Meg *et al.*, 2012; Gibson, 2025**).**

Nutrition screening

The identification of malnourished individuals requiring intervention can be accomplished by nutrition screening. This involves a comparison of measurements on individuals with predetermined risk levels or "cutoff" points using measurements that are accurate, simple and cheap, and which can be applied rapidly on a large scale. Nutrition screening can be carried out on the whole population, targeted to a specific subpopulation considered to be at risk, or on selected individuals. The programs are usually less comprehensive than surveys or surveillance studies.

Numerous nutrition screening tools are available for the early identification and treatment of malnutrition in hospital patients and nursing homes, of which Subjective Global assessment (SGA) and the Malnutrition Universal Screening Tool (MUST) are widely used. In low-income countries, mid-upper-arm circumference (MUAC) with a fixed cutoff of 115mm is often used as screening tool to diagnose severe acute malnutrition (SAM) in children aged 6–60mos. In some settings, mothers have been supplied with MUAC tapes either labeled with a specific cutoff of < 115mm, or color-coded in red (MUAC < 115mm), yellow (MUAC = 115–124mm), and green (MUAC > 125mm) in an effort to detect malnutrition early, before the onset of complications, and thus reduce the need for inpatient treatment. In the United States, screening is used to identify individuals who might benefit from the Supplemental Nutrition Assistance Program (SNAP). The program is means tested with highly selective qualifying criteria. The SNAP (formerly food stamps) program provides money loaded onto a payment card which can be used to purchase eligible foods, to ensure that eligible households do not go without foods. In general, studies have reported that participation in SNAP is associated with a significant decline in food insecurity**.**

The U.S. also has a Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) that targets low-income pregnant and postpartum women, infants, and children < 5 years. In 2009, the USDA updated the WIC food packages in an effort to balance nutrient adequacy with reducing the risk of obesity. Guthrie *et al.*, (2020) compared associations between WIC participants and the nutrients and food packages consumed in 2008 and in 2016 using data from cross-sectional nationwide surveys of children aged < 4 years. The findings indicated that more WIC infants who received the updated WIC food packages in 2016 had nutrient intakes (except iron) that met their estimated average requirements (EARs). Moreover, vegetables provided a larger contribution to their nutrient intakes, and intakes of low-fat milks had increased for toddlers aged 2 years, likely contributing to their lower reported intakes of saturated fat (Gibson, 2025).

Nutrition interventions

Nutrition interventions often target population subgroups identified as "at-risk" during nutrition surveys or by nutrition screening. In 2013, the Lancet Maternal and Child Nutrition Series recommended a package of nutrition interventions that, if scaled to 90% coverage could reduce stunting by 20% and reduce infant and child mortality by 15%**.** The nutrition interventions considered included lipid-based and micronutrient supplementation, food fortification, promotion of exclusive breast feeding, dietary approaches, complementary feeding, and nutrition education. More recently, nutrition interventions that address nutrition-sensitive agriculture are also being extensively investigated. Increasingly, health-care program administrators and funding agencies are requesting evidence that intervention programs are implemented as planned, reach their target group in a cost-effective manner, and are having the desired impact. Hence, monitoring and evaluation are becoming an essential component of all nutrition intervention programs. However, because the etiology of malnutrition is multi-factorial and requires a multi-sectorial response, the measurement and collection of the data from such multiple levels presents major challenges.

Monitoring, oversees the implementation of an intervention, and can be used to assess service provision, utilization, coverage, and sometimes the cost of the program. Effective monitoring is essential to demonstrate that any observed result is probably from the intervention. Emphasis on the importance of designing a program theory framework and associated program impact pathway (PIP) to understand and improve program delivery, utilization, and the potential of the program for nutritional impact has increased. The construction of a PIP helps conceptualize the program and its different components (i.e., inputs, processes, outputs, and outcomes to impacts). Only with this information can issues in program design, implementation, or utilization that may have the potential to limit the impact of the program, be identified, and, in turn strengthened, so the impact of the program can be optimized. Program impact pathway analysis generally includes both quantitative and qualitative methods (e.g., behavior-change communication) to ascertain the coverage of an intervention (Gibson, 2025).

Program impact pathway analysis can also be used to ascertain the coverage of an intervention. Bottlenecks at each sequential step along the PIP can be identified along with the potential determinants of the bottlenecks**.** Coverage can be measured at the individual and at the population level; in the latter case, it is assessed as the proportion of beneficiaries who received the intervention at the specified quality level. Many of the nutrition interventions highlighted by Bhutta and Colleagues (2013) in the Lancet Maternal and Child Nutrition Series have now been incorporated into national policies and programs in low- and middle-income countries. However, reliable data on their coverage are scarce, despite the importance of coverage to ensure sustained progress in reducing rates of malnutrition. In an effort to achieve this goal, Gillespie *et al.* (2019) have proposed a set of indicators for tracking the coverage of high impact nutrition- specific interventions which are delivered primarily through health systems, and recommend incorporation of these indicators into data collection mechanisms and relevant intervention delivery platforms. For more details, see Gillespie *et al.* (2019). The evaluation of any nutrition intervention program requires the choice of an appropriate design to assess the performance or effect of the intervention. The choice of the design depends on the purpose of the evaluation and the level of precision required (Gibson, 2025).

Nutritional assessment methods

Historically, nutritional assessment systems have focused on methods to characterize each stage in the development of a nutritional deficiency state. The methods were based on a series of dietary, laboratory- based bio- markers, anthropometric, and clinical observations used either alone or, more effectively, in combination. Today, these same methods are used in nutritional assessment systems for a wide range of clinical and public health applications. For example, many low and middle-income countries are now impacted by a triple burden of malnutrition, where under-nutrition, multiple micronutrient deficiencies, and over-nutrition co-exist. Hence, nutritional assessment systems are now applied to define multiple levels of nutrient status and not just the level associated with a nutrient deficiency state. Such levels may be associated with the maintenance of health, or with reduction in the risk of chronic disease; sometimes, levels leading to specific health hazards or toxic effects are also defined (Van den Berg *et al.,* 2013**).**

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There is now increasing emphasis on the use of new functional tests to determine these multiple levels of nutrient status. Examples include functional tests that measure immune function, muscle strength, glucose metabolism, nerve function, work capacity, oxidative stress, and genomic stability**.** The correct interpretation of the results of nutritional assessment methods requires consideration of other factors in addition to diet and nutrition. These may often include socioeconomic status, cultural practices, and health and vital statistics, which collectively are sometimes termed "ecological factors". When assessing the risk of acquiring a chronic disease, environmental and genetic factors are also important **(**Carmel, 2011**).**

Dietary assessment methods

Dietary assessment methods provide data used to describe exposure to food and nutrient intakes as well as information on food behaviors and eating patterns that cannot be obtained by any other method. The data obtained have multiple uses for supporting health and preventing disease. For example, health professionals use dietary data for dietary counseling and education and for designing healthy diets for hospitals, schools, long-term care facilities and prisons. At the population level, national food consumption surveys can generate information on nutrient adequacy within a country, identify population groups at risk, and develop nutrition intervention programs. Dietary data can also be used by researchers to study relation- ships between diet and disease, and for formulating nutrition policy such as food-based dietary guidelines. It is important to recognize that nutrient inadequacies may arise from a primary deficiency (low levels in the diet) or because of a secondary deficiency. In the latter case, dietary intakes may appear to meet nutritional needs, but conditioning factors (such as certain drugs, dietary components, or disease states) interfere with the ingestion, absorption, transport, utilization, or excretion of the nutrient(s). Several dietary methods are available, the choice depending primarily on both the study objectives and the characteristics of the study group. Recently, many technical improvements have been developed to improve the accuracy of dietary methods. These include the use of digital photographs of food portions displayed on a cell-phone or a computer tablet, or image-based methods utilizing video cameras, some wearable. Some of these methods rely on active image capture by users, and others on passive image capture whereby pictures are taken automatically. Under development are wearable camera devices which objectively measure diet without relying on user-reported food intake. Several on-line dietary assessment tools are also available, all of which standardize interview protocols and data entry: they can be interviewer- or self-administered **(**Gibson 2025).

Data on knowledge, attitudes and practices, and reported food-related behaviors are also collected. Historically, this has involved observing the participants, as well as in-depth interviews and focus groups approaches based on ethnological and anthropological techniques. Today, e-health (based on the internet) and m-health (based on mobile phones) communication technologies are also being used to collect these data, as noted earlier (Olson, 2016). All these methods are particularly useful when designing and evaluating nutrition interventions. Often, information on the proportion of the population "at risk" of inadequate intakes of nutrients is required. Such information can be used to ascertain whether assessment using more invasive methods based on nutritional bio- markers is warranted in a specific population or subgroup.

Laboratory Methods

Laboratory methods are used to measure nutritional biomarkers which are used to describe status, function, risk of disease, and response to treatment. They can also be used to describe exposure to certain foods or nutrients, when they are termed "dietary biomarkers". Most useful are nutritional bio- markers that distinguish deficiency, adequacy and toxicity, and which assess aspects of physiological function and/or current or future health. However, it must be recognized that a nutritional biomarker may not be equally useful across different applications or life-stage groups where the critical function of the nutrient or the risk of disease may be different**.** The Biomarkers of Nutrition and Development (BOND) program has defined a nutritional biomarker as: "a biological characteristic that can be objectively measured and evaluated as an indicator of normal biological or pathogenic processes, and/or as an indicator of responses to nutrition interventions" **(**Moy *et al.*, 2009**)**.

Nutritional biomarkers can be measurements based on biological tissues and fluids, on physiological or behavioral functions and, more recently, on metabolic and genetic data that in turn influence health, well-being, and risk of disease. Yetley and Colleagues (2017) have highlighted the difference between risk biomarkers and surrogate biomarkers. A risk biomarker is defined by the Institute of Medicine (2010) as a biomarker that indicates a component of an individual's level of risk of developing a disease or level of risk of developing complications of a disease. As an example, metabolomics is being used to investigate potential risk biomarkers of pre-diabetes that are distinct from the known diabetes risk indicators (glycosylated hemoglobin levels, fasting glucose, and insulin) **(**Moy *et al.*, 2009**).**

Classification of nutritional biomarkers

1. Biomarkers of "exposure": food or nutrient intakes; dietary patterns; supplement usage. Assessed by:
   i. Traditional dietary assessment methods
   ii. Dietary biomarkers: indirect measures of nutrient exposure
2. Biomarkers of "status": body fluids (serum, erythrocytes, leucocytes, urine, breast milk); tissues (hair, nails)
3. Biomarkers of "function": measure the extent of the functional consequences of a nutrient deficiency.
   i. Functional biochemical: enzyme stimulation assays; abnormal metabolites; DNA damage. These biomarkers serve as early biomarkers of subclinical deficiencies.
   ii. Functional physiological/behavioral: more directly related to health status or disease such as vision, growth, immune function, taste acuity, cognition, depression. These biomarkers impact on clinical and health outcomes.

Functional physiological and behavioral bio-markers are more directly related to health status and disease than are the functional biochemical biomarkers. Disturbances in these functional physiological and behavioral biomarkers are generally associated with more prolonged and severe nutrient deficiency states, and are often affected by social and environmental factors so their sensitivity and specificity are low. In general, functional physiological tests (with the exception of physical growth) are not suitable for large-scale nutrition surveys: they are often too invasive, they may require elaborate equipment, and the results tend to be difficult to interpret because of the lack of cutoff points. The growing prevalence of chronic diseases has led to investigations to identify biomarkers that can be used as substitutes for chronic disease outcomes. Chronic disease events are characterized by long developmental times, and are multifactorial in nature with challenges in differentiating between casual and associative relations. To qualify as a biomarker that is intended to substitute for a clinical endpoint, the biomarker must be on the major causal pathway between an intervention (e.g., diet or dietary component) and the outcome of interest (e.g., chronic disease). Such biomarkers are termed "surrogate" biomarkers; only a few such biomarkers have been identified for chronic disease. Examples of well accepted surrogate biomarkers are blood pressure within the pathway of sodium intake and cardiovascular disease (CVD) and low-density lipoprotein-cholesterol (LDL) concentration within a saturated fat and CVD pathway; see for more details. Increasingly, it is recognized that a single biomarker may not reflect exclusively the nutritional status of that single nutrient, but instead be reflective of several nutrients, their interactions, and metabolism. This has led to the development of "all-in-one" instrument platform that conduct multiple micronutrient tests in a single sample aliquot, as noted earlier **(**Satia *et al.*, 2024**).**

Anthropometric methods

Anthropometric methods involve measurements of the physical dimensions and gross composition of the body (WHO, 1995). The measurements vary with age (and sometimes with sex and race) and degree of nutrition, and they are particularly useful in circumstances where chronic imbalances of protein and energy are likely to have occurred. Such disturbances modify the patterns of physical growth and the relative proportions of body tissues such as fat, muscle, and total body water. In some cases, anthropometric measurements can detect moderate and severe degrees of malnutrition, but cannot identify specific nutrient deficiency states. The measurements provide information on past nutritional history, which cannot be obtained with equal confidence using other assessment techniques. Anthropometry is used in both clinical and public health settings to identify the increasing burden of both under- and over-nutrition that now co-exist, especially in low- and middle-income countries. Measurements can be performed relatively quickly, easily, and reliably using portable equipment, provided standardized methods and calibrated equipment are used (Gibson *et al.,* 2025).

Standardized methods exist to evaluate anthropometric indices based on Z-scores or percentiles; both calculated in relation to the distribution of the corresponding anthropometric index for the healthy reference population Often Z-scores of below −2 or above +2 are used to designate individuals with either unusually low or unusually high anthropometric indices, especially in low-income countries. When used in this way, the combination of index and reference limit is termed an "indicator", a term that relates to their use in nutritional assessment, often for public health, or social/medical decision-making. There is growing concern about the global pandemic of obesity; individuals with obesity are at higher risk of several chronic diseases, including coronary heart disease, diabetes, and hypertension.

Consequently, numerous investigators have compared the usefulness of anthropometric variables such as body mass index (weight, kg) / (height, m), (BMI) and waist circumference as surrogate measures of obesity. In a meta-analysis of studies with at least a 12mos follow-up, Seo *et al.*, (2017) concluded that waist circumference was a better predictor for diabetes than BMI (> 30) in women than men and for all ages > 60 years, whereas neither BMI > 30, nor waist circumference > 102cm (for men), > 88cm (for women) were significant predictors of hypertension.

Clinical methods

A medical history and a physical examination are the clinical methods used to detect signs, (observations made by a qualified examiner) and symptoms (manifestations reported by the patient) associated with malnutrition or risk of chronic disease. The latter is defined by IOM (2010) as a culmination of a series of pathogenic processes in response to internal or external stimuli over time that results in a clinical diagnosis/ ailment and health outcomes; examples include diabetes, cancer, coronary heart disease, stroke, and arthritis. The signs and symptoms may be nonspecific and develop only during the advanced stages of a nutrient deficiency (or excess) or chronic disease; for this reason, their diagnosis should not rely exclusively on clinical methods. It is obviously desirable to have the capacity to detect marginal nutrient deficiencies and risk of chronic disease before a clinical syndrome develops. Several laboratories- based biomarkers exist to assess an individual's level of risk of developing a disease and as substitutes for chronic disease outcomes; they are often included as an adjunct to clinical assessment. Examples include serum ferritin for risk of iron deficiency anemia, glycosylated hemoglobin (HbA1c) for risk of diabetes, and alterations in bone mineral density for changes in fracture risk. Examples of surrogate bio- markers intended to substitute for chronic disease outcomes include LDL cholesterol instead of the true clinical outcome CVD and blood pressure for cardiovascular disease, as noted earlier **(**Gibson *et al.*, 2025**).**

The Food Record

A food record is a comprehensive recording of all foods, beverages, and dietary supplements that a participant in a research study consumed within a designated period of time. Usually 3–4 days of intake are recorded as participant burden generally causes a decline in the quality of information recorded if more days are recorded. Ideally dietary intakes are weighed and measured, but are more often estimated by participants preceding and after consumption. Training of participants greatly enhances the accuracy of reporting. The use of food records requires a literate and motivated population. Previous reports have described reactivity as an issue with record keeping that is changing usual dietary patterns for ease of recording or social desirability to report foods perceived as "healthy" (Thompson and Byers., 1994).

The 24-hour dietary recall (24HR)

A 24HR is a means to assess an individual's intake over the previous 24 hours. Ideally, multiple 24HRs on non-consecutive, random days would be collected. The 24HR has traditionally been interviewer administered over the phone or in person, but 24HR are also collected in person or online (e.g. Automated-Self-Administered. The use of ASA-24 in general reduces interviewer burden and costs, allows the participant to answer questions at their own pace, and is free; but, may not be feasible for all study populations (Subar *et al.*, 2012; Casey *et al.*, 1999).

The use of probing questions aids the ease of responses and has been shown to enhance data accuracy. The probes include food preparation methods, additions made after preparation (i.e. condiments, butter, spices) as well as time of the eating occasion. Multiple 24HR are needed to account for large day-to-day variation in dietary intakes. Other factors such as day of the week (i.e. week day verses weekend), mode of interview (telephone, face to face, over the Internet), and the number and sequence of the 24HRs are known to influence reported energy intakes. Macronutrient estimates obtained from the 24HR are generally more stable than those of vitamins and minerals. Other dietary components, like cholesterol, are found in many foods but are not as consistent as macronutrients. Some foods and dietary components (e.g. liver and Vitamin A) are consumed in large quantities by some individuals but, rarely or never others. Large day-to-day variability has been reported for cholesterol, Vitamin C and Vitamin A. For these reasons, some foods and nutrients can be accurately quantified by a few days of 24HR whereas other nutrients require upwards of weeks. As with the food record, participant motivation decreases with longer periods of assessment, leading to reduce data quality (Gersovitz *et al.*, 1978).

Multiple benefits of the 24HR over other dietary assessment strategies exist. First, literacy of subject is not required (if collected over the phone). Second, the 24HR allows for data collection of individuals with physical disability (e.g. blindness, lack of ability to write due to injury or arthritis). If administered by an interviewer, the recall is collected in "real time" and thus interpretation problems are minimized because subjects can clarify directly to the interviewer. This also eliminates errors in response and missing data. The recall has the potential to capture a wider variety of foods and dietary supplements that may be limited by specific dietary questionnaires or screeners. For research purposes, the 24HR are administered on random days, after the foods and beverages have been consumed, reducing reactivity.

Weaknesses of the 24HR also exist. Extensive training of the interviewer, combined with the necessary software to collect 24HR makes it an expensive technique. The expense precludes the availability of this method for large sample sizes, such as those participants in large epidemiological studies. This assessment tool relies on memory. Seasonal variability (i.e. the time of the year that the data are collected) can introduce a bias estimate of food and nutrient intakes. These and other factors contribute to within-person variation. Nevertheless, statistical tools to mitigate this within-person variation to help to make multiple 24HRs (i.e. short terms assessment methods) reflective of usual or habitual intakes have been described intakes (NRCNA. 1986; Dodd *et al.*, 2006).

Dietary Pattern

Dietary pattern (DP) is the general profile of food and nutrient consumption which is characterized on the basis of the usual eating habits. The analysis of dietary patterns gives a more comprehensive impression of the food consumption habits within a population. It may be better at predicting the risk of diseases than the analysis of isolated nutrients or foods because the joint effect of various nutrients involved would be better identified (Hu, 2002). Also, since nutrient intakes are often associated with certain dietary patterns single-nutrient analysis may be confounded by the effect of dietary patterns. Patterns of nutritional behaviors adopted in childhood and adolescents are mostly continued in adult life and increase the risk of development of many chronic diseases. Diets in childhood and adolescents have public health implications due to evidence relating poor nutrition in childhood to subsequent obesity and elevated risks for type 2 diabetes, metabolic syndrome, and cardiovascular diseases, which are increasing in prevalence (WHO, 2004; Canete, *et al.,* 2007).

Studies have shown that adolescence leaving their parents and living away from home to attend college experience numerous health-related behavioral changes, which includes adoption of unhealthy dietary habits Strong, Parks, Anderson, Winett, & Davy, 2008; Wengreen & Moncur, 2009). These adopted habits are mostly attributed to drastic changes in the environment and resources available, frequent exposure to unhealthy foods and habits (Huang *et al.*, 2003).

Many undergraduate students are adolescents who encounter numerous health risks along the path to adulthood, many of which affect quality of life and life expectancy. Studies have shown that youths are particularly vulnerable to poor eating habits and are said to be in the habit of eating "junks" (Papadaki and Scott, 2002). These poor eating habits may likely arise from lack of knowledge of the cumulative effects of their eating habits. In Nigeria, where there is an increase in fast food centers in its urban cities, it is a major concern (Ajala, 2006; Akinwusi and Ogundele, 2005). Most undergraduates are likely to be responsible for their diets for the first time away from home; therefore, they need guidance on how to make informed dietary choices (Satia, Galanko, and Siega-Riz, 2004). Other studies have linked the lifestyle of students, especially breakfast consumption, to their mental abilities which is reflected in their academic performance (Lisa, 1998; Pollit, Watkins, and Husaini, 1997). However, most of these studies have excluded young adults in the tertiary institution. Since poor dietary habits is a lifestyle challenge undergraduate students face while in school.

Students Eating Habits

Eating habits among students are influenced by multiple behavioral, social, and environmental factors. El Ansari *et al.,* (2015) reported that meal skipping, irregular eating schedules, and frequent snacking are common patterns among young adults. *Yahia et al.,* (2016) found that 45% of surveyed students skipped breakfast regularly, citing lack of time as the major cause. Breakfast omission, however, is associated with lower academic performance and reduced metabolic efficiency (Burrows, Whatnall, and Patterson, 2017).

In developing contexts, economic constraints and food availability further shape eating habits. Ojo, Adebayo, and Okolie (2019) revealed that Nigerian students often substitute proper meals with low-cost street foods such as pastries and instant noodles. These foods, though convenient, are high in sodium and trans fats, contributing to overweight and cardiovascular risk. Peer influence is another determinant. Mizia, Felińczak, and Włodarek (2021) found that students living in dormitories exhibited similar food preferences, driven by social dining experiences. Such habits can reinforce either positive or negative dietary practices depending on group norms.

Nutritional Requirement for Students

University and Polytechnic students represent a unique demographic group with distinct nutritional demands due to their physical, cognitive, and psychosocial development. Adequate nutrient intake is essential to sustain the mental alertness, concentration, and immunity required for academic performance. According to Salama and Esmail (2018), nutrition education directly improves students' understanding of nutrient balance, leading to better food choices and body weight regulation. Most students from tertiary institutions recognized the importance of nutrition, less than half practiced consistent meal planning.

The micronutrient needs of students are particularly critical. Iron, zinc, folate, calcium, and omega-3 fatty acids are essential for maintaining cognitive efficiency, stress tolerance, and hormonal balance (El Ansari, Suominen, and Samara, 2015). Inadequate consumption of these nutrients leads to anemia, low immunity, and mental fatigue.

Making smart nutritional choices can be very important for optimal well-being and academic performance. There are many actions that college students can take to eat in a healthful way and enjoy their college years without jeopardizing their health from excessive weight gain or weight loss. Among some recommendations are:

- Avoid skipping meals. When a meal is skipped, the subsequent hunger may cause one to overeat
- Eat breakfast, which helps concentration and increases the likelihood of consuming calcium, folic acid, and vitamin C. these nutrients are often low in the diet of college students
- Manage portion sizes. If portion sizes are underestimated, one may eat more calories than are needed. Also, the availability of a wide variety and mass quantities of "dorm" food (pizza, soda, etc.) may promote overeating and a significant increase of total energy intake.
- Drink water and eat fruit throughout the day. Water is calorie-free and fruits help manage urges to eat and contribute fiber, vitamins, and minerals.
- Exercise regularly. Physical activities help burn off calories, helps manage stress, and promotes mental and physical stamina.

Try the low-calorie, low-fat, and vegetarian options available around campus. As part of a well-planned diet, these items can help manage total energy intake and introduce one or two items that can become part of a regular diet. Etc.

Note that a poor diet may have an injurious impact on health, causing deficiency diseases such as blindness, anemia, scurvy, preterm birth, still birth and cretinism, health-threatening conditions like obesity and metabolic syndrome and such common chronic system disease as cardiovascular disease, diabetes, and osteoporosis. A poor diet can cause the wasting of kwashiorkor in acute cases, and the stunting of marasmus in chronic cases of malnutrition. A healthy diet is a big part of any successful self-care plan. Nutrition has been linked with emotional, physical, and cognitive health. Eating a healthy diet gives the brain and bodies the vitamins and minerals needed to stay well. However, healthy eating habits can be difficult to maintain, especially if there is a mental disorder. Diet affects the brain neurochemistry that controls mood and response to stress, the way the brain and body interact, and the higher brain functions that control learning, memory and intellectual functioning.

Dietary Reference Value (DRV)

Dietary reference value, DRV, is a set of standards of the amount of each nutrient needed to maintain good health. People differ in the daily amounts of nutrients they need; for most nutrients, the measured average requirement plus 20% (statistically 2 standard deviation takes care of the needs of nearly everyone and in the UK, this is termed Reference Nutrient Intake, elsewhere known as Recommended Daily Allowances or Intakes (RDA or RDI), Population Reference Intake (PRI), or Dietary Reference Intake (DRI). This figure is used to calculate the needs of large groups of people in institutional or community planning.

Types of Dietary Reference Value

DRVs can be divided into three types. These are;

1. RNI – Reference Nutrient Intake (95% of the population's requirement is met)
2. EAR – Estimated average requirement (50% of the population's requirement is met)
3. LRNI – Lower Recommended Nutritional Intake (5% of the population's requirement is met)
4. RNI is not the same as RDA (Recommended Daily Allowance) or GDA, although they are often similar.

METHODOLOGY

A detailed record of the entire food and drink consumed for a period of three working and one weekend day by a group of fifteen (15) male and fifteen (15) female Polytechnic students were taken. The record included an accurate description of the product and a close estimate of its weight was taken using a measuring scale. The recorded food and drink were converted into energy and nutrients using a 'microdiet software'. Participants were encouraged to take record of every food and drink before and after consumed for accurate record. Data obtained were subjected to statistical analysis. One way ANOVA, SPSS version 26, Microsoft excel version 10 were used.

RESULTS/FINDINGS

Table 1: 4 Day Average Energy and Nutrient Intake of Male Students (Raw data from Microdiet software)

Students Males	Energy Kcal	Prot g	Fat g	SFA g	Carbs g	Tot Sugar g	Alcohol (Alc) g	NSP g	Vit A µg	Thiamin mg	Vit C mg	Iron mg	Calcium mg	Sodium mg
1	743	68	22	5	72	11	0	3	169	0.6	13	38	1104	726
2	2142	163	76	20	217	103	0	10	511	2.2	41	15	688	2859
3	1318	47	62	14	152	56	0	12	716	0.9	46	8	466	1492
4	1757	90	45	18	249	69	0	6	301	0.9	79	9	327	908
5	724	37	22	5	102	11	0	3	495	1.4	67	11	317	1340
6	2166	71	78	23	313	124	0	15	336	1.4	73	9	922	2249
7	1181	63	45	13	139	32	0	9	296	1.1	52	7	454	1686
8	1877	79	85	20	210	81	0	13	401	1.3	148	11	527	1996
9	1828	34	77	24	260	162	0	4	189	0.6	8	4	508	1253
10	2329	120	88	20	281	143	0	13	649	1.3	57	13	971	4120
11	1042	50	35	14	141	47	0	7	207	1.1	39	8	835	1817
12	3780	125	126	32	572	244	0	32	491	2.5	286	19	1542	4722
13	1503	73	65	21	161	66	0	5	292	0.8	36	8	597	1567
14	1622	66	51	23	241	114	0	12	410	1.4	196	10	1159	2142
15	1393	34	65	19	180	105	0	9	98	0.7	105	4	418	325
DRV	**2550**	**55.5**	**94 max**	**28 max**	**320**	**120 max**	**32 max**	**18**	**700**	**1**	**40**	**8.7**	**700**	**1600**

Table 2a: 4 Day Average Energy and Nutrient Intake

Students Males	Energy kcal	Prot g	% Prot %	Fat g	% Fat %	SFA g	% SFA %	Carbs g	% Carbs %
1	743	68	36.60834	22	26.64872	5	6.056528	72	38.76178
2	2142	163	30.43884	76	31.93277	20	8.403361	217	40.52288
3	1318	47	14.26404	62	42.33687	14	9.559939	152	46.1305
4	1757	90	20.48947	45	23.05065	18	9.220262	249	56.68754
5	724	37	20.44199	22	27.34807	5	6.21547	102	56.35359
6	2166	71	13.11173	78	32.40997	23	9.556787	313	57.8024
7	1181	63	21.33785	45	34.29297	13	9.898477	139	47.07875
8	1877	79	16.83538	85	40.75653	20	9.589771	210	44.75226
9	1828	34	7.439825	77	37.91028	24	11.81619	260	56.89278
10	2329	120	20.6097	88	34.00601	20	7.728639	281	48.26106
11	1042	50	19.19386	35	30.23033	14	12.09213	141	54.12668
12	3780	125	13.22751	126	30	32	7.619048	572	60.5291
13	1503	73	19.42781	65	38.92216	21	12.57485	161	42.84764
14	1622	66	16.2762	51	28.2984	23	12.76202	241	59.4328
15	1393	34	9.763101	65	41.99569	19	12.27566	180	51.68701
N	15	15	15	15	15	15	15	15	15
AVE	1693.667	74.66667	18.63104	62.8	33.34263	18.06667	9.691276	219.3333	50.79112
STD	757.8512	36.85622	7.430244	27.53491	5.975575	7.065678	2.237836	118.8016	7.196951
DRV	**2550**	**55.5**		**94 max**		**28 max**		**320**	

Table 2b: 4 Day Average Energy and Nutrient Intake (continuation of table 2)

Tot Sugar g	Alcohol (Alc) g	% Alc %	NSP g	Vit A µg	Thiamin mg	Vit C mg	Iron mg	Calcium mg	Sodium mg
11	0	0	3	169	0.6	13	38	1104	726
103	0	0	10	511	2.2	41	15	688	2859
56	0	0	12	716	0.9	46	8	466	1492
69	0	0	6	301	0.9	79	9	327	908
11	0	0	3	495	1.4	67	11	317	1340
124	0	0	15	336	1.4	73	9	922	2249
32	0	0	9	296	1.1	52	7	454	1686
81	0	0	13	401	1.3	148	11	527	1996
162	0	0	4	189	0.6	8	4	508	1253
143	0	0	13	649	1.3	57	13	971	4120
47	0	0	7	207	1.1	39	8	835	1817
244	0	0	32	491	2.5	286	19	1542	4722
66	0	0	5	292	0.8	36	8	597	1567
114	0	0	12	410	1.4	196	10	1159	2142
105	0	0	9	98	0.7	105	4	418	325
15	15	15	15	15	15	15	15	15	15
91.2	0	0	10.2	370.7333	1.213333	83.06667	11.6	722.3333	1946.8
61.96912	0	0	7.173363	177.5727	0.544933	74.88035	8.270429	356.0186	1191.449
120 max	**32 max**		**18**	**700**	**1**	**40**	**8.7**	**700**	**1600**

Table: 3: Showing the significant level of *P*<0.05 for male students'

Nutrient	Ave. Intake	DRV	% DRV	P -Value
Energy	1693.67	2550	66	0.001
Prot	74.67	55.5	135	0.064
Fat	62.80	94	67	0.001
SFA	18.07	28	65	0.0001
Carbs	219.33	320	69	0.005
Tot Sugar	91.20	120	76	0.093
Alcohol	0.00	32	0	0.000
NSP	10.20	18	57	0.001
Vit A	370.73	700	53	0.0001
Thiamin	1.21	1	121	0.153
Vit C	83.07	40	208	0.043
Iron	11.60	8.7	133	0.196
Calcium	722.33	700	103	0.812
Sodium	1946.80	1600	122	0.279

Table 4: Showing Percentage Energy Contribution

Nutrient	Ave. Intake	% Energy Contribution
Energy	1693.67	
Prot	74.67	17.6
Fat	62.80	33.4
Carbs	219.33	51.8
Alcohol	0.00	0.0

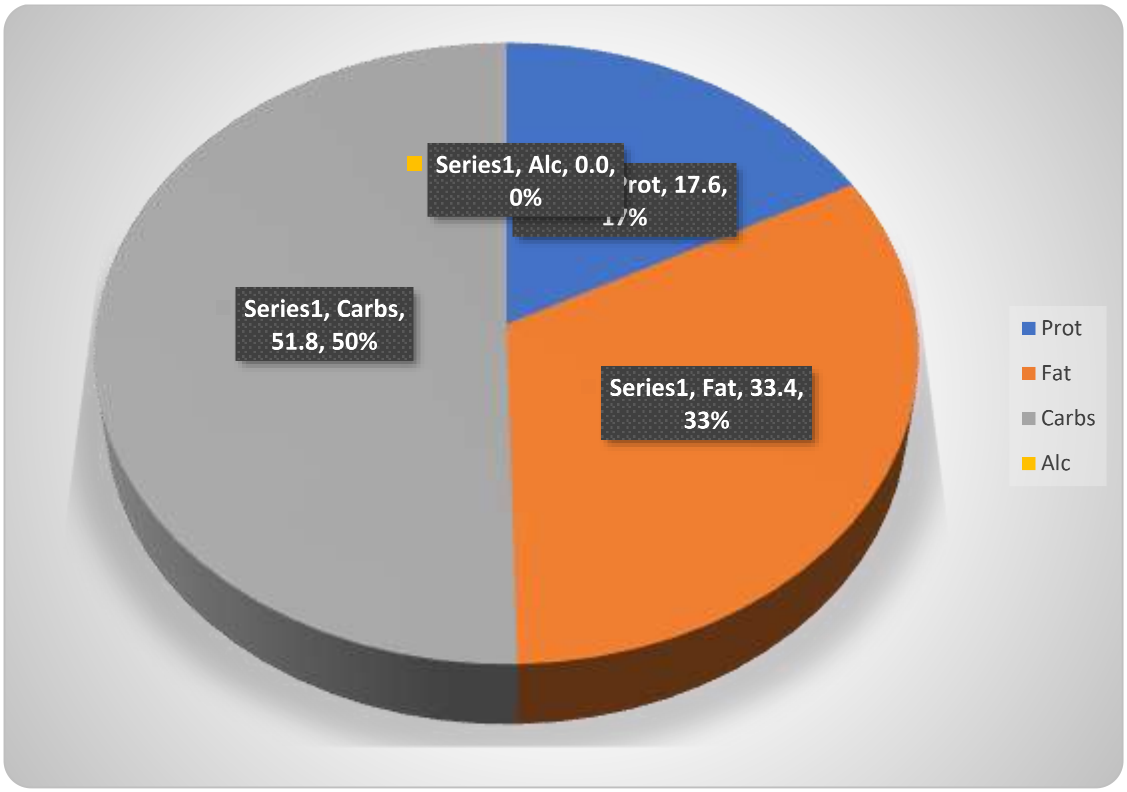

Figure 1: Pie chart showing percentage energy contribution from intake of food and drinks by group of 15 male students'

Table 5: 4 Day Average Energy and Nutrient Intake of Female Students

Students Females	Energy kcal	Prot g	Fat g	SFA g	Carbs g	Tot Sugar g	Alcohol (Alc) g	NSP g	Vit A µg	Thiamin mg	Vit C mg	Iron mg	Calcium mg	Sodium mg
1	1517	73	64	24	174	63	0	8	1329	1.4	27	8	733	3033
2	1444	86	56	13	160	47	0	8	1451	1.4	55	8	478	1884
3	1696	70	88	41	161	101	3	8	768	1.2	136	5	2162	2236
4	1138	58	49	16	125	34	0	12	531	0.8	52	7	327	1452
5	911	47	27	8	128	57	0	7	184	0.6	21	4	469	1153
6	972	33	40	15	127	42	0	6	322	0.5	35	5	454	1310
7	818	42	35	9	88	22	0	6	216	0.5	8	4	166	1426
8	968	34	51	15	94	13	0	6	136	0.5	33	4	112	1489
9	885	48	39	13	88	15	0	6	319	0.6	28	15	558	1392
10	1024	47	27	11	158	68	0	10	163	1.1	69	8	398	1520
11	820	44	31	8	98	55	0	5	567	0.4	48	3	156	913
12	1425	53	70	23	155	65	0	8	244	1.1	62	7	615	2266
13	1241	38	30	10	175	91	24	3	89	0.7	51	4	396	1228
14	1833	77	80	30	218	122	0	19	671	1.2	196	10	1400	1849
15	1167	65	41	12	144	55	0	13	415	1.1	48	10	599	1912
N														
AVE														
SDV														
DRV	**1940**	**45**	**71 max**	**21.5 max**	**240**	**90 max**	**24 max**	**18**	**600**	**0.8**	**40**	**14.8**	**700**	**1600**

Table 6a**:** 4 Day Average Energy and Nutrient Intake of Female Students

Students Female	Energy kcal	Prot g	% Prot g	Fat g	% Fat g	SFA g	% SFA g	Carbs g	% Carbs g
1	1517	73	19.24852	64	37.96968	24	14.23863	174	45.88003
2	1444	86	22.67633	56	33.22347	13	7.712591	160	42.18853
3	1696	70	18.45748	88	52.20831	41	24.32432	161	42.45221
4	1138	58	15.29334	49	29.07053	16	9.492419	125	32.95979
5	911	47	12.39288	27	16.01846	8	4.74621	128	33.75082
6	972	33	8.701384	40	23.73105	15	8.899143	127	33.48715
7	818	42	11.07449	35	20.76467	9	5.339486	88	23.20369
8	968	34	8.965063	51	30.25709	15	8.899143	94	24.78576
9	885	48	12.65656	39	23.13777	13	7.712591	88	23.20369
10	1024	47	12.39288	27	16.01846	11	6.526038	158	41.66117
11	820	44	11.60185	31	18.39156	8	4.74621	98	25.84047
12	1425	53	13.97495	70	41.52933	23	13.64535	155	40.87014
13	1241	38	10.01978	30	17.79829	10	5.932762	175	46.1437
14	1833	77	20.30323	80	47.4621	30	17.79829	218	57.48187
15	1167	65	17.13909	41	24.32432	12	7.119314	144	37.96968
N	15	15	15	15	15	15	15	15	15
AVE	1117.125	51.875	14.36861	46.4375	27.93157	16.4375	10.13328	131.75	35.42992
SDV	324.3122	16.43457	4.333441	19.44173	11.53432	9.272591	5.501208	37.50594	9.889502
DRV	**1940**	**45**		**71 max**		**21.5 max**		**240**	

Table 6b: 4 Day Average Energy and Nutrient Intake (continuation table 6)

Students Female	Tot Sugar g	% Tot Sugar g	Alc g	% Alc g	NSP g	Vit A µg	Thiamin mg	Vit C mg	Iron mg	Calcium mg	Sodium mg
1	63	16.61173	0	0	8	1329	1.4	27	8	733	3033
2	47	12.39288	0	0	8	1451	1.4	55	8	478	1884
3	101	26.63151	3	1.384311	8	768	1.2	136	5	2162	2236
4	34	8.965063	0	0	12	531	0.8	52	7	327	1452
5	57	15.02966	0	0	7	184	0.6	21	4	469	1153
6	42	11.07449	0	0	6	322	0.5	35	5	454	1310
7	22	5.800923	0	0	6	216	0.5	8	4	166	1426
8	13	3.427818	0	0	6	136	0.5	33	4	112	1489
9	15	3.955175	0	0	6	319	0.6	28	15	558	1392
10	68	17.93013	0	0	10	163	1.1	69	8	398	1520
11	55	14.50231	0	0	5	567	0.4	48	3	156	913
12	65	17.13909	0	0	8	244	1.1	62	7	615	2266
13	91	23.99473	24	11.07449	3	89	0.7	51	4	396	1228
14	122	32.16875	0	0	19	671	1.2	196	10	1400	1849
15	55	14.50231	0	0	13	415	1.1	48	10	599	1912
N	15	15	15	15	15	15	15	15	15	15	**15**
AVE	54.0625	14.94541	2.625	1.716175	8.75	463.75	1.75625	55.25	7.3125	21.43958	1567.375
SDV	30.8491	8.134237	6.189853	2.856228	3.921856	416.6413	0.353486	48.13889	3.211586	530.0562	539.4864
	90 max		**24 max**		**18**	**600**	**0.8**	**40**	**14.8**	**700**	**1600**

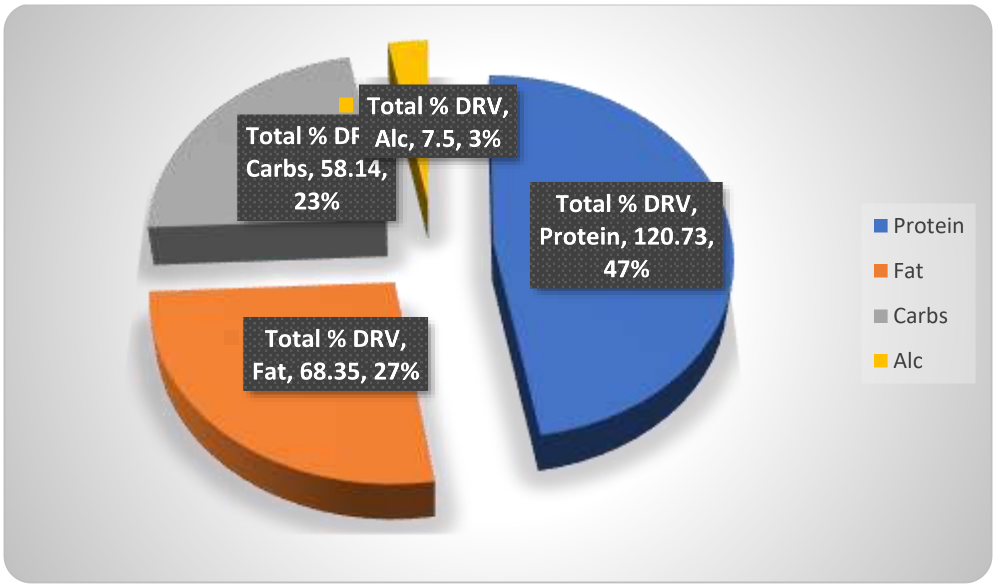

Figure 2: Pie Chart Showing Total Percentage Energy Contribution from Food and Drink Intake by Group of Female Students

DISCUSSION

Implication to Research and Practice

Carbohydrates are one of the main classes of nutrients. They are the most important source of energy for the body. The digestive system changes carbohydrates into glucose (blood sugar). The body uses this sugar for the cells, tissues and organs.

Carbohydrates are called simple or complex depending on their chemical structure. Simple carbohydrates include sugars found naturally in food such as fruits, vegetables, milk, and milk products. They also include sugars added during food processing and refining. Complex carbohydrates include whole grain breads and cereals, starchy vegetables and legumes. Many of the complex carbohydrates are good sources of fiber.

The diet is low in carbohydrates and this can result in fatigue and weakness also known as reduced energy. As a result of this, ketosis (a condition characterized by raised levels of ketone bodies in the body, associated with abnormal fat metabolism and diabetes mellitus) occurs in the absence of carbohydrates when glycogen is depleted. To avoid this, adequate energy-giving food has to be moderately consumed.

The average carbohydrate intake was higher compared to the DRV. One sample test showed that the carbohydrate intake was lower than the DRV. Proteins are essential nutrients for the human body. They are one of the building blocks of body tissue, and can also serve as a source of fuel. As a fuel, proteins contain 4 kcal/gram, just like carbohydrates and unlike lipids, which contain 9 kcal/gram. There are nine amino acids which human must obtain from their diet in order to prevent protein-energy malnutrition. Sources of proteins include grains, legumes and nuts, as well as animal sources such as meats, dairy products, fish and eggs. Protein is a nutrient needed by the human body for growth and maintenance. When broken down into amino acids, they are used as precursors to nucleic acids, co-enzymes, hormones, immune response, cellular repair, and other molecules essential for life. Additionally, protein is needed to form blood cells.

Extreme protein intake, coupled with inadequate intake of other calorie sources (fat or carbohydrates), can cause a form of metabolic disturbance and death commonly known as rabbit starvation. Even when consuming other calorie sources, consuming more than 285g of protein per day (for an 80kg person) may be unsafe. Moderate intake of proteins with other calories will prevent metabolic disturbances caused by too much protein intake.The protein intake of the respondents was high compared to the DRV. Though the average protein intake was higher than DRV, one sample test revealed that the differences were significantly high (Bilsborough and Mann, 2006).

Fats also known as triglycerides are esters of three main fatty acid chains and the alcohol glycerol. Fat is an important foodstuff for many forms of life and fat serve both structural and metabolic functions. Some fatty acids that are set free by the digestion of fats are called essential because they cannot be synthesized in the body from simpler constituents. There are two essential fatty acids in human nutrition: alpha-linolenic acid (an omega-3-fatty acid) and linoleic acid (an omega-6-fatty acid).

Fat intake is moderately low and can lead to difficulty in absorbing fat-soluble vitamins which are vitamins A, D, E and K, depression, increased cancer risk, imbalance of nutrients esp. carbohydrates, over eating. To prevent these, fat should be moderately taken in meals. The respondents had average total fat intake which was significantly lower than the maximum DRV.
A saturated fat is a fat in which the fatty acids all have single bonds. Double bonds can react with hydrogen to form single bonds. Most animal fats are saturated. Examples of food containing a high proportion of saturated fat include animal fat products such as cream, cheese, butter, and other whole milk dairy products and fatty meats which will contain dietary cholesterol. Certain vegetable products have high saturated fat contents such as coconut oil and palm kernel oil (USNLM, 2009). The intake from the diet is moderate and should be maintained to avoid risks of deficiency or overdose. The saturated fat intake among the population was found to be significantly lower than the DRV.

Free sugar is defined by the world health organization as "all monosaccharide and disaccharides added to food by the manufacturer, cook, or consumer, plus sugars naturally present in honey, syrups and fruit juices". It is used to distinguish between the sugars that are naturally present in fully unrefined carbohydrates such as brown rice, whole wheat pasta, fruit, etc. and those sugars (or carbohydrates) that have been, to some extent, refined. The total sugar intake of respondents was lower than the corresponding guideline daily amounts with significant difference.

Alcohol unlike protein, carbohydrates, and fat is metabolized immediately it gets into the body system because there is nowhere for it to be stored. Once alcohol enters the stomach, up to 20% of it can be metabolized there and go directly into the bloodstream. Within minutes, it reaches the brain and gives the feeling of being a stimulant. No other nutrient is able to do this. The remaining alcohol goes to the intestines and is absorbed there with the rest of the nutrients. A small amount of alcohol is excreted through sweat, saliva, urine and breath. Alcohol intake was 0% for the male and 3% for the female of DRV.

This is the indigestible portion of food derived from plants. It has two main components which are the soluble fiber which dissolves in water, is readily fermented in the colon into gases and physiologically active byproducts, and can be pre-biotic and viscous, the other is insoluble which does not dissolve in water and is metabolically inert and provides bulking. Bulking fibers absorb water as they move through the digestive system, easing defecation. Dietary fibers are found in fruits, vegetables and whole grains.

We reject the null hypothesis (deficient NSP) and accept the alternate meaning the student's nutrient contain sufficient fiber. The average intake of non-starch polysaccharides (NSP) among the population was significantly lower compared to DRV.

This is a group of unsaturated nutritional organic compounds, that includes retinol, retinal, retinoic acid, and several provitamin A carotenoid, and beta-carotene. It is important for growth and development, for the maintenance of the immune system and good vision. Food source are carrots, kale, cod liver oil, liver, spinach, pumpkin, sweet potatoes, papaya etc. There was a significant difference in the average vitamin A intake of the population than the DRV.

Thiamine, also called vitamin B_1, a substance that enables carbohydrates in the body to release the energy required for cellular function, known as metabolism. Thiamine also plays a vital role in the activities of enzymes, proteins that are involved in bodily processes such as digestion. Good sources of thiamine include wheat germ, dry beans, peas, enriched cereals and breads, pasta, nuts, eggs, and most vegetables. Lean pork is one of the best sources of the vitamin, as are organ meats, such as liver. The intake of thiamine in diet is normal and this should be maintained to avoid health risks associated with deficiency or overdose.

The average thiamin of the population was lower than the DRV. However, one sample T-test was insignificantly high. Ascorbic Acid or Vitamin C, a food substance needed by humans to prevent scurvy, a disease of the gums, bones, and blood vessels, and to increase the body's resistance to infection. Ascorbic acid acts as an *antioxidant,* a nutrient that chemically binds and neutralizes the tissue-damaging effects of substances in the environment known as free radicals. As a result, ascorbic acid is vital for the growth and maintenance of healthy bones, teeth, gums, ligaments, and blood vessels. Because of its role in the formation of *collagen*, the body's major building protein, ascorbic acid is a central component of all body organs.

Ascorbic acid occurs naturally in many fruits and vegetables, particularly in tomatoes, citrus fruits, cantaloupe, broccoli, spinach, green peppers, cabbage, and potatoes. The vitamin is easily destroyed by cooking or canning foods and by exposure to air and light. There is conflicting evidence that taking large doses of ascorbic acid will either prevent the common cold or reduce the severity of its symptoms.

The average vitamin C intake of the respondents was higher than percentage DRV. Despite the very high average intake for the population, 4 out of 15 respondents actually had lower vitamin C intake than the DRV of 40mg/day while one respondent alone had 286mg/day as the highest and the other respondent having 8mg/day as the lowest, thereby making the average figure to be surprising. One sample test confirmed that the difference between the DRV and the average vitamin C intake in the respondents was significant.

Iron is a mineral that is found in a range of foods. It helps to transport oxygen around the body, making it essential for life. It is also important for producing energy, optimal immune function, and storing oxygen in our muscles. Animal based iron sources are beef, chicken liver, lamb brains, pork, snapper, chicken, etc. plant-based iron sources are kidney beans, green lentils, tofu, chickpeas, cashew nuts, almonds, raw spinach, etc.

Deficiency in iron is characterized by the following symptoms; fatigue, lack of concentration, increased risk of infection, headache, pale skin, and weakness/dizziness and this can be solved by increasing intake of iron in iron-containing food. Fascinatingly, the average iron intake in respondents was though insignificantly higher than DRV.

Calcium is required for the normal maintenance and development of the skeleton as well as for the proper functioning of neuromuscular and cardiac function. Low intakes of calcium have been associated with a condition of low bone density called osteoporosisFrom the result above, the calcium intake of the student is moderate and okay and this should be maintained. The respondents had calcium intake insignificantly higher than the corresponding DRVs. The average calcium intake of the population was very high compare to DRV.

Sodium is a cat ion needed to maintain extracellular volume and serum osmolality. It is found in most food as sodium chloride, generally known as salt. It is also present in the diet as sodium bicarbonate and as monosodium glutamate in processed foods, in seasonings, additives, condiments, meat, fish, poultry, dairy foods, egg, smoked meat, olives and pickled foods. The effect of high salt consumption on long term health outcomes is controversial. Some associations include; stroke and cardiovascular disease, high blood pressure, left ventricular hypertrophy, edema, stomach cancer, etc. this can be prevented by limiting too much salt consumption. Sodium intake was higher though insignificant for the population for the population than the corresponding DRV (Goulding, 2007).

The percentage energy contribution from carbohydrate, fat, protein and alcohol in the respondents can found in figure 1 and figure 2. With the exception of thiamin, iron, calcium, and sodium intakes, there was significant difference in the energy and nutrient intakes analyzed. The result obtained showed that the average energy intake among the subjects was lower than the estimated average requirements. This could result in weight loss in some students. However, this could be good because they will not be tending towards overweight or even obese condition. Also, their low energy is not a serious problem because the physical activity level of an individual influences the energy intake and not just meeting the DRV. It will be important to add that students' need of energy is majorly for academic work. The lower average energy intake is due to the observed low fat and carbohydrate intakes since they are the major source of dietary energy. A possible reason could be that the students may be having lower amount or number of meals per day as students are likely to skip meals for lectures or busy with academic work. The respondents have some knowledge about the contribution of excessive consumption of energy dense foods to health issues such as obesity and so might be selectively changing their dietary intakes to avoid being at risk. However, the observe percentage energy from fat to the daily total energy intake in the population was just that of DRV of 33% (Department of health, 1991). This could however compensate for the lack of energy from alcohol. Saturated fat intake which is of serious concern due to its risk of causing cardiovascular diseases was found to be below the maximum DRV. The average percentage energy contribution from saturated fat was 7.1% for the population for the population. The figure was just approximately the maximum DRV of 10%.

The average daily protein intakes of the subjects exceeded the DRVs. This is good sign that the population of students is likely to be getting essential amino acids in the diets. The protein intake results reflect that protein deficiency is unlikely to occur. Nevertheless, it is also possible that the students might have overrated the intake of food sources rich in protein to create a picture of healthy eating.

Daily intakes of NSP were significantly lower than the DRVs in the respondents. This could be due to skipping of breakfast meals which are mostly cereals rich in NSP. Low or occasional consumption of fruits and vegetables which are also rich sources of NSP could be another reason for the observed low intakes. Care should be taken in regards to the NSP intakes so as to avoid its associated risks of diverticulitis disease, constipation, bowel cancer and diabetes. This is link with vitamin C.

The relatively higher intakes of vitamin C could be attributed to high intakes of fruits juices and or fruits and vegetables. This might be detrimental to the dental health of the respondents. Vitamin C is essential for some hydroxylation reasons in the body and functions as non-specific reducing agent and antioxidants. It also helps in the absorption of non-heam iron plant sources, prevention of scurvy and healing of wounds (Sheaff, 2007). Deficiency of vitamin A is linked with the inability to see in dim light, known as night blindness and also causes infertility in males (Thumham, 2007). It is of great concern that in this study the respondents consumed low amount of vitamin A. The observed low intake of vitamin A will therefore have a negative effect on the subjects.

The results of this study provide useful information about some key nutrient intakes of the student's population. However, some possible sources of error may limit the findings of this study. Firstly, the study was done for a period of four days. Most dietary studies are carried out for seven days although this can be of high burden on the respondents, Secondly, students' diet may differ depending on the time of the academic calendar (for example examination times can be horrible and affect many students from healthy eating). Also, there is likelihood that students might have underestimated or overestimated some of the food intakes. Weighed dietary records would be better to give authentic amounts of foods consumed. The Microdiet software is based on food tables of McCance and Widdowson's composition of foods (2002) and so there exist some intrinsic inaccuracy and coding errors. The subjects might have changed their dietary intakes during the period of the study for easy recording. Also, the study was sample bias and as such the small sample size may not reflect the actual dietary nutrient and energy intakes of the whole students or general population. This accounts for some of the errors /limitations linked with dietary studies.

CONCLUSION

The average energy intake among the student's respondents was significantly lower than the DRVs. However, the percentage energy contributions from carbohydrate, fat and saturated fat to the total energy was quite appropriate in comparison with the DRVs.

The protein intakes in respondents were insignificantly higher than the DRV. The respondents had average total fat intake significantly lower than the maximum DRV.The saturated fat intake among population was insignificantly lower than the maximum DRV. The average total carbohydrate intakes were lower than the DRV among the population insignificantly. The total sugar intakes of respondents were also lower than the corresponding guideline daily amounts with significant difference. The respondents had intakes of non-starch polysaccharides (NSP) significantly lower than DRV. The average vitamin C intake among the respondents was appreciably higher than the DRV. The respondents had an insignificantly high mean thiamin intake. Calcium was high but vitamin A intake among the respondents were lower than the DRVs. It is disturbing that sodium intakes exceeded the maximum DRV.

The lower energy intake among the respondents may be due to skipping of males especially breakfast for lectures or academic work. Students should be advised on the need to avoid skipping important meals of the day. Excessive intake of salt (sodium) through high consumption of processed foods should be avoided. Rich sources of NSP and vitamin A should be included in the diet to overcome the observed lower intakes and associated risks. However, due to the small sample size and possible sources of error, further studies need to be done to ascertain the findings of this study. To reduce error, it is recommended that the weighed food record method of dietary study should be encouraged.

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