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As researchers and practitioners in the area of obesity, we are familiar with the different types of obesity that are prevalent and the alarming increase of younger children that are impacted globally. Moreover, we recognise the health problems concerned with the relationship between obesity and the lack of physical activity, with the drain on health funding with increased teeth extractions, type 2 diabetes and heart conditions, to name but a few. In an attempt to combat this global epidemic, there are many policies and interventions in place which work in conjunction to address obesity. One such example is the globally recognised recommendation by the World Health Organisation¹ to encourage between 30-60 minutes of exercise per day, depending on age. However, to the general population, such advice seems too simplistic and neglects to recognize the difficulties that individuals have with becoming more physically active.

In order to appreciate some of these health concerns, it is increasingly evident that we need to get our young people’s attention and show them how real and pressing these issues are for their future. In an attempt to illustrate what being obese is like from a phenomenological perspective, an experiment was conducted for \( n = 8 \) sport and exercise undergraduate degree university students to actually ‘feel’ what it was like to be obese in a practical environment. The experiment was designed to highlight the physical constraints of being obese and provide them with an opportunity to reflect on whether recommendations by WHO¹ were realistic.

As part of the practical, students took part in a series of two sets of six tests. Body mass (kg) was measured at rest and they performed to the best of their ability in four standardised physical fitness field testing parameters. These included, (sit and reach (cm), vertical jump (cm), Illinois Agility run (s) and 10 m sprint (s)). On completion of the field tests, a 2 minute (s) exercise bout of low impact and low intensity was conducted on a motorised walker with a Polar heart rate monitor (bpm). All results were recorded as Pre. Students then put on a bariatric weighted suit which consisted of a padded leg section with jeans (size 60 cm waist circumference), padded arm section with sweater (size 6 XL) and weighted torso section (20 lbs in weight). This suit is normally used with the National Health Service to train nurses, so designed in such a way to not only represent weight but size. Students repeated all six tests and all results were recorded as Post.

The mean results of eight students revealed that sit and reach test ranged from Pre 28.0 cm to Post -20.0 cm with an overall reduction of 48 cm and the vertical jump ranged from Pre 46.0 cm to Post 20.0 cm and a reduction of 26 cm. The 10 m sprint ranged from Pre 2.2 s to Post 5.7 s with an increase of 3.5 s and the largest time increase was found with the Illinois agility run which ranged from Pre 12.7 s to Post 27.8 s, with an overall increase of 40.5 s. Body mass measurements showed no difference in measurement except for the Post 20 lb increase. Finally, results from the two minute exercise bout indicated that the Pre resting heart rate averaged 56 bpm, which would appropriately represent the sample population. However, after two minutes of low intensity and low impact exercise, post testing heart rate increased to 148 bpm which is an increase of 92 bpm or 164%.

The students noted an abrupt customisation of wearing the bariatric suit. This was
particularly evident with the 164% increase in heart rate. This led to a discussion at the end of the practical about the significant increase in heart rate and stress being placed on the heart and whether the link between 30 minutes of physical activity is realistic given these findings. Furthermore, students had to deal with significant adaptation of their running style for both the 10 m sprint and Illinois Agility Run, and moving from a standing to sitting position on the floor in preparation for the sit and reach test. These changes in mechanical processes posed challenges that the students had not considered and let to a further discussion about the stress that 30 minutes of physical activity could have upon joints.

In summary, there are plenty of other avenues to explore within an experiment of this type, including nutritional, sociological, psychological, physiological, and biomechanical processes. However, within the context of this practical example, it provided an opportunity for students to appreciate, albeit briefly, what it is like to be obese from a physical point of view. Key findings suggested mechanical problems were encountered when having to move with the bariatric weighted suit and more alarmingly the 164% increase of the heart rate from a two minute exercise bout. As such, the short term WHO recommendation of 30 minutes a day was considered appropriate in principle, but given the practical’s findings not realistic until weight loss and careful heart monitoring during aerobic activity is in place.

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Sports or Physical Activity for the Inactive World: Should we be Encouraging Safer Physical Activity Patterns more than Sports?

Ahmad Alkhatib

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The scientific evidence on the positive effects of physical activity as part of a healthy lifestyle is well established. Physical activity has both direct and indirect effects for preventing several chronic diseases, including cardiovascular disease (CVD), obesity, diabetes and cancer. Healthcare policies across the globe have developed numerous strategies to encourage physical activity with several calls for action to prevent and decrease overweight and obesity, such as calls for action in the US Department for health and Human Services in 2001, the UK House of Commons Health Committee report on obesity and the Department of Health physical activity guidelines in 2004. Moreover, numerous implementation initiatives have encouraged physical activity and sports participation with an aim of achieving health outcomes and cost saving strategies for healthcare.

However, the promotion of physical activity, guidelines and calls for action have often implemented the terms of “physical activity” and “sports” interchangeably. Referring to physical activity benefits and the associated desired health outcomes has often been confused with encouraging sports participation. Numerous government initiatives have attempted to address the physical activity guidelines amongst different population groups by weighing them heavily towards promoting sports and less so for physical activity. A public misconception, for example, is that being physically active is conveyed through encouragement to participate in often competitive sports such as football, triathlon, cycling, running, football or even rugby and boxing. Furthermore, physical education in many countries seems to have primarily focussed on developing sports skills, whilst governments and local councils seem to directly or indirectly encourage the idea that being physically active is translated by doing sports. The most recent government policies in the UK have continued to recommend “Playing sport helps to keep people healthy and is good for communities. Playing sport at school or in a local club is also the first step to competition at the highest level”. Playing competitive sport has also formed a large part of the London 2012 Olympics legacy, despite questionable outcomes in terms of sustainable populations’ participation and the associated health outcomes, since it was first implemented in 2004. Hosting major tournaments is likely to increase participation in specific sports, such as the England 2015 Rugby World Cup, and Qatar’s planned Football World Cup in 2022, even though not much attention have been given to deal with the risks associated with competitive sports participation, or to translate the sports’ health benefits into promoting a safer physical activity.

Competitive sports, especially team sports are associated with a higher risk of injury compared with physical activities such as walking and gardening. Perhaps performing such a comparison may not be possible. However, to encourage the idea that being physically active is only translated by doing sports in order to gain the health benefits may be at odds with the established physical activity health benefits. In fact, the word “sports” has only been mentioned 3 times compared with the word “physical activity” which was mentioned 105 times within the World Health Organisation (WHO) global strategy on physical activity and health.

By definition, physical activity is any bodily movement produced by the skeletal muscles that uses energy. This includes exercise and other activities such as playing, walking,
doing household responsibilities or gardening. Regular and organised physical activity can form the term “exercise” and is known to be associated with less risk of injury compared with doing “sports” with soccer as a prime example. It has recently been reported that approximately 37 paediatric sport or recreational injuries are treated hourly in the United States. In particular, team sports injuries such as soccer that tend to peak during the teen years. Perhaps the common Anterior Cruciate Ligament (ACL) injuries provide a simple example of how recreational soccer results in adverse effects on physical activity participation. Reflecting on a personal experience at a known Sports Medicine department, it was striking to see the high number of individuals, who visited the orthopaedic department to be treated for a soccer-related ACL injury within a short space of time. The prolonged rehabilitation process often lasts from six months to 2 years. Returning to being active is often compounded by the fear of re-injury. The injury-related deficits are often combined a very little attention paid to meeting the minimum physical activity guidelines throughout the prolonged rehabilitation process, with some deterioration of physical fitness, all potentially increase the risk of CVD. Therefore, in terms of injury prevention, implementing physical activity guidelines should not be confused with promoting sports but should rather be concerned with less competitive physical activity initiatives.

Traditionally, being healthy and physically active behaviours have been focussed on irregular physical patterns, such as those associated with manual work such as farming, carpentering etc. This type of being physically active has empirically been found to be associated with longevity and reduced risks of CVD. For example, a traditional Mediterranean lifestyle encompasses an active lifestyle alongside a healthy diet, and is strongly associated with reduced CVD and longevity. Perhaps, the message should be multifaceted involving obesity researchers, clinicians, sport professionals and government bodies to work together to implement a balanced message for populations’ physical activity guidelines.

Undoubtedly, the message encouraging sports participation across different participant groups has marked benefits for health, particularly amongst children and adolescents, and developing sports competitiveness contributes to the nation’s reputation and economical growth. However, in terms of injury prevention, implementing physical activity guidelines should not be confused with promoting sports. It may be time that we start to consider emphasising more on physical activity rather than sports.

REFERENCES


The occurrence of overweight and obesity has risen around the world. This rate will increase in the future without appropriate interventions. Obesity is a condition with increased percentage of fat mass. Evidence based studies indicate that excess adiposity is accompanied with a proinflammatory state. This low grade chronic inflammation could initiate and progress the metabolic disorders such as insulin resistance, type 2 diabetes, endothelial dysfunction, atherosclerosis and several types of cancers. There are outstanding differences between obesity induced inflammation and classic inflammation. Classic inflammation originates from the intense immune system response to an insult, results in Basal Metabolic Rate (BMR) increase and usually diminishes over time. In contrast, obesity induced inflammation is chronic, metabolic, moderate, and is associated with a reduced BMR. Some studies suggested the term “metaflammation” for this inflammatory condition.

Adipokines are bio factors, which secreted from white adipose tissue. Variety physiologic and pathophysiologic roles of adipokines have been recognized in inflammation, immunity and metabolism. The interplay between adipokines and inflammatory response may elucidate the process of diseases. In the obese state, the dysregulation of proinflammatory and anti-inflammatory adipokines could partly explain the inflammatory mechanism of obesity and its related consequences. Furthermore, adipokines could play a potential role in physiopathology of many inflammatory and autoimmune diseases through their endocrine, paracrine and autocrine activities.

A wide spectrum of proinflammatory adipokines ranging from the well-recognized classic ones such as IL-6 and TNF-α, to recently discovered peptides including resistin, lipocalin 2, RBP4 (retinol-binding protein 4) and ANGPTL 2 (angiopoietin-like protein) have been identified to be involved in metabolic disorders, insulin resistance and endothelial dysfunction. On the other hand, anti-inflammatory adipokines including adiponectin, omentin, Zinc-a2-glycoprotein (ZAG), Secreted Frizzled-Related Protein 5 (SFRP5), Interleukin-10 (IL-10), C1q/TNF-Related Protein (CTRP) family, Interleukin-1 Receptor Antagonist (IL-1RA), Transforming Growth Factor β (TGF-β), Growth Differentiation Factor 15 (GDF15) potentially could counteract with these disorders.

To achieve a therapeutic strategy for various obese complications increasing the production of anti-inflammatory biomarkers is of special importance. The imbalance between proinflammatory and anti-inflammatory adipokines could be resolved to some extent by different interventions. Various pharmacological, lifestyle and dietary interventions have been examined as anti-inflammatory therapies in the obese state. However, there are controversies regarding the effectiveness of these interventions in altering the adipokines and more importantly insulin resistance in obesity. Among dietary interventions weight loss, omega-3 fatty acids and their metabolites Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) are the most studied examples. Others include investigating the effects of dietary patterns (Mediterranean, low fat diet, etc.), tomato juice, grape seed oil, nuts (walnut, almond, and hazelnut), green tea, rice bran, etc.
The point that should be noted is that despite the emphasis on the importance of increasing anti-inflammatory factors and targeting the root causes of inflammation rather than merely inhibiting inflammatory factors, most studies have focused primarily on suppression of well-known inflammatory mediators such as Interleukin-6 (IL-6) and Tumor Necrosis Factor-α (TNF-α). This is a great disappointment that these interventions could not remarkably improve the major inflammation associated disorders including glucose homeostasis.

To interpret the results it is required to respond to this basic challenging question that whether there is any benefit of suppressing metaflammation. In fact, despite the destructive effects of inflammation on insulin resistance and the metabolism of fat tissue, there may be potential benefits of inflammation in obesity, which has not been considered enough. Expanding evidence propose the essential role of proinflammatory cells and mediators in providing sufficient blood flow of adipose tissue through angiogenesis, regulation of metabolism, adipose tissue remodeling, and adipocyte differentiation, however, these beneficial effects are the matter of discussion.

Proinflammatory cytokines including TNF-α, IL-6 and Interleukin-18 (IL-18) may exert different and even favorable effects in the obese state. The proinflammatory factor IL-15 might be an example of the positive function of inflammation in obesity. According to recent studies, IL-15 lessens weight gain and lipogenesis probably by enhancing energy expenditure and activating brown fat. It has affirmative effects on improving insulin sensitivity and glucose metabolism too. IL-15 activates inflammation-associated pathways including IKK/NF-κ B, JAK/STAT and PI3K/Akt. Thus, we need to know whether the advantages of the suppression of this metabolic inflammation outweighs disadvantages. Moreover, to what extent we are allowed to neutralize the inflammation to prevent the inhibition of compensatory effects of inflammation and damage to the organism. Another interesting question would be whether we could perform purposive interventions with the aim to distinguish between positive and negative effects of inflammation.

In summary, future studies aimed at identifying inflammatory and anti-inflammatory adipokines and mediators, or evaluating the effectiveness of interventions on inflammation suppression should consider both the detrimental and potentially beneficial effects of inflammation. We require to further experimental and clinical studies, which improve and equilibrate our perspective on obesity-induced inflammation. Since we need to know how much the inflammation associated with obesity is compensatory and how much is destructive.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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**Challenges of Healthy Eating Habits in Rural Communities**

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**ABSTRACT**

The purpose of this study is to utilize multiple case study to investigate the challenges of healthy eating habits in rural communities in Arkansas, and to identify the differences between these communities (Community A and B) that could be associated with overweight and obese children. The findings suggested that healthy eating habits required a conscientious effort on the part of the parents and/or guardians in urging the children to eat healthy. Parents and/or guardians also needed to show good examples of healthy eating behaviors at home. In addition, community leaders should be thinking of some modalities to enhance the food choices or provide healthier choices in their community events and support underprivileged families to help secure healthy food choices. This study also highlighted the importance of food corps and health coalition group in the curtailment of overweight and obese children in rural communities.

**KEYWORDS:** Healthy eating; Overweight; Parenting; Obese; Eating habits.

**ABBREVIATIONS:** BMI: Body Mass Index; TPB: Theory of Planned Behavior; PBC: Perceived Behavior Control.

**INTRODUCTION**

Having balanced nutritional habits early in life has shown to be exponentially beneficial to health later in one’s life. Encouraging healthy eating habits at an early age has also shown to aid in preventing the onset of diet-related diseases and complications in the future. Healthy eating has been defined as consumption patterns, practices, and behaviors that are consistent with improving, maintaining, and/or enhancing health. New foods are often approached with a mixture of interests and fear. Research has shown that children who start trying new foods and have plentiful options to choose from at an early age appear to have healthier diets throughout childhood. Exposure to new foods at an early age as well as positive reinforcement from a parental figure or valued opinion has shown to aid in children and adolescents to be more involved in healthy eating behaviors.

The implications of unhealthy eating habits cannot be overemphasized. It was noted that people with easy access to energy dense, inexpensive foods (unhealthy food choices) combined with less energy expenditure (physical activity) requirements in their daily life tended to show a higher rate of obesity. The obesity epidemic has increased rapidly over the past three decades in both children and adults. The rampant occurrence of weight related disorders in children, such as type 2 diabetes and hypertension, are believed to be a consequence of the ever growing obesity outbreak. Childhood Body Mass Index (BMI) is related to an increased risk of various cardiovascular diseases in adulthood.

Previous generations used to believe that a chubby child was equivalent to a healthier child; but, within the past decade in developed na-
Obesity Research has debatably transitioned into primary childhood health problems. The effect of television viewing is thought to buttress, weight gain, not only by eliminating physical activity, but also by increasing energy intake, as previous research has shown children tended to consume excess amounts of energy dense foods during the television watching process and exposure to commercials.

In 2003, the State of Arkansas passed one of the first legislative initiatives to combat childhood obesity, Arkansas Act 1220. The Act set into motion annual BMI measurements for children in public schools in grades K-12, the elimination of student access to vending machines during the school day in elementary schools and public reporting of vending contracts, hiring of Community Health Promotion Specialists to work with schools and communities, development of a statewide Child Health Advisory Committee and a physical activity advisory committees pertaining to the use of scientific evidence in regard to physical activity and nutritional regulations for schools. Several amendments were added to this Act following its release, such as confidentiality changes. Originally student’s BMI scores would be on the student’s report cards, but this was soon changed to allow for more privacy and reduce any animosity or embarrassment that might develop amongst the students. Parents were mailed separate copies of the reports without the student learning any of the results post testing. A statewide BMI database was also developed following this change. The annual reports on BMI succeeded in raising awareness of overweight or obese children and even recommended changes that could be made within the household. They also suggested families follow up with their health care providers for more detailed assessments since BMI was simply a screening tool. However, the incidence of childhood obesity in the state is still very high. Indicating that Act 1220 will not be effective without healthy eating habits and lifestyles. Hence, the purpose of this study is to investigate the challenges of healthy eating habits in rural communities in Arkansas.

Prevention of childhood obesity has many aspects ranging from individual, family, institutional, community and health care settings. There exists little evidence in regards to the most effective way to prevent the development of childhood obesity. Various periods exist during childhood where both challenges and windows for opportunity exist to help prevent obesity. These periods include the first year of life and the period of “adiposity rebound”, ages 3-7 years old. For children a large portion of learning about food and eating occurs during the move from an exclusively milk diet as an infant to the omnivore diet consumed in their early childhood. Caregivers and families would be great in identifying a child’s energy intake and potential healthy eating habits and lifestyle. In addition, institutional facilities and community-level prevention methods could include prospective areas to increase knowledge of nutrition (healthy eating habit) and obesity, along with campaigns and advertisements to combat the obesity epidemic.

Theory of Planned Behavior

The theoretical basis for this study is the theory of planned behavior which denotes that individuals are more likely to carry out a specific behavior when a significant figure in that individual’s life thinks he or she should or should not implement the behavior. The Theory of Planned Behavior (TPB) is a widely used psychological model that reveals the facets influencing behavior. The TPB suggests that the mightiest predictor of any person’s behavior is his or her own intention to perform the behavior. Behavior or intention is the result of three primary qualifications: attitudes, subjective norms, and Perceived Behavior Control (PBC). Attitude is often denoted by each individual’s assessment of the behavior in question. Subjective norms tend to portray each individual’s opinion regarding the people who are significant figures in their life and what they think about the individual’s implementing or not implementing the behavior. PBC denotes each individual’s capacity to execute a behavior. Barriers that potentially prevent an individual from carrying out a behavior are also suggested.

TPB is a well-studied and respected theory for illuminating and forecasting behavior. Multiple studies have applied this theory to a widespread assortment of health perspectives, including food and beverage consumption behaviors. Even though there exists various definitions and measures of food and beverage consumption, as mentioned in these studies, there also exists an unadulterated idea that TPB is an excellent predictor of a range of measures of food and beverage consumption behavior for various populaces. TPB dictates that individuals have a higher chance to perform a specific health behavior if three requirements are met: they trust that the new behavior will lead to particular outcomes that they value, if they think that individuals whose opinions they value think they should implement the behavior, and if they believe that they have the necessary means and chances to accomplish the behavior. This theory has been applied multiple times in an attempt to understand various food and beverage consumption behavior intentions among young people.

It has been shown that parental food preferences, intake patterns, and eating behaviors influence the foods available to young children. Also, parents tend to serve as role models for children’s behavior, which in turn affects early learning in regard to food preferences and eating behaviors in children. Similarly, researchers have taken note of the effects of observational learning on children and have shown that observational learning affects children’s intake. Observing others consuming healthier foods can aid in promoting children’s acceptance of healthier food options. As such, parents need to ensure that they are not merely instructing their children that they need to eat healthy. They also must be demonstrating healthy eating
habits in order for their children to learn and reinforce this behavior. When it comes to risk taking behaviors children were more prone to mimic parents behaviors, more so than what their parents tell them.30 Which goes against the well-known saying, “Do as I say, not as I do”.31 (p. 502) Researchers have concluded that behavioral changes related to health and interventions have regularly found greater effects for theory-based interventions compared to those without a comprehensive theoretical basis.32-34 Children look to their parents and caregivers to help encourage, support, and enable them to practice healthier eating habits.25 The notion of self-identity also has been advanced as a possible predictor of behavior.35 Research indicated that people who considered themselves to be “green customers” had stronger intentions to consume organic vegetables than those who did not consider themselves green.36 (p. 394)

TPB can be quite beneficial for phases of intervention development, application, and assessment. Given the demonstrated helpfulness of the TPB in understanding an extensive variety of health associated factors, including food and beverage consumption behaviors, this theory was selected as the foundational standard for understanding this case study.

RESEARCH METHODOLOGY

The objectives of this case study were as follows: (a) to examine how children develop interest in what they eat; (b) to examine how children develop interest in healthy eating; (c) to examine what healthy foods community members/parents would add to children’s meals; (d) to examine what foods they would remove from children’s meals; and (e) to examine the barriers to healthy eating.

Case study research was selected due to the need to accumulate thorough data on the obesity epidemic that was occurring in rural communities in Arkansas.37,38 Case study approaches were particularly advantageous for this study due to the exploratory nature and depth of understanding that could be achieved.39 A multiple-case study approach allowed for a more direct comparison and exploration of differences of the challenges and intervention strategies in the various considered contexts.38,40 It also served to provide more generic conclusions to be formulated.41 Since comparisons were to be formulated, it was crucial that the cases were chosen methodically so that similar or contrasting results could be predicted across both cases , based on a theory.38

Case study research also allowed for the opportunity to check for validity of the interviewee’s replies due to the nature of the personal communication and of experienced interviewers. Table 1 provides an overview of the measures, which were conducted during each stage of the current research to address the concerns regarding validity and reliability.

<table>
<thead>
<tr>
<th>Reliability and Validity Criterion</th>
<th>Research Phase</th>
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<td>Research Phase</td>
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<td></td>
<td>Design</td>
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<td></td>
<td>Develop and utilize case study interview questionnaire</td>
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<td>Reliability:</td>
<td>Theoretical framework established prior to data analysis</td>
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<td>denotes the operations of a study can be repeated with the same results</td>
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<td>Internal Validity:</td>
<td>Constructs from previous empirical works adapted to the field of childhood obesity</td>
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<td>creates a causal relationship whereby certain conditions are shown to lead to other conditions, as denoted by false relationships</td>
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<tr>
<td>Construct Validity:</td>
<td>Sampling within rural communities with high and low prevalence of childhood obesity</td>
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<td>creates proper operational measures for the concepts being researched</td>
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<tr>
<td>External Validity:</td>
<td>N/A</td>
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<td>creates a domain in which the researches’ findings can be generalized</td>
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Table 1: Measures taken to ensure the validity and reliability of the research conducted (based on reference.38,44)
Case Selection

Two rural counties (communities) in Northwest Arkansas were selected. Each community was purposefully selected and had either a high or low prevalence of obesity in order to allow for exploration of causes and interventions. State BMI and census data was analyzed to aid in selection of rural communities.

Data Collection: The fundamental data collection method used was structured interviews with an open ended interview protocol. This allowed for those being interviewed to openly express their comments without being limited to select answer choices. Thus, detailed and in-depth data and perceptions were gathered from the community members. In addition, the community members who participated in the study were all presented with a consent form in regard to ethical clearance (Institutional Review Board document) about the study prior to data collection.

A purposive sampling approach was employed to garner participants. This approach ensured a practical structure for the discussion sequence and facilitated the comparison of the groups in the data analysis. All structured interviews were recorded and transcribed by the researchers.

Structured interviews were held at three (3) separate times and locations between the two (2) rural communities during the first week of June 2015. A total of 16 participants were interviewed in order to explore healthy eating habits, activities, and their relationship between overweight or obese children in both communities. Structured interviews lasted anywhere from 60-90 minutes with an average of 73 minutes. Interviews were conducted with highly ranked individuals within the community, ranging from the mayor, nurses, principals, and childcare center directors. Many teachers, parents, and cafeteria cooks were also interviewed. The interviews were conducted by two experienced case study researchers.

Detailed notes were taken during the interviews and additional material, stemming from census data and BMI data, were used for triangulation. Overall, an in-depth case study protocol and a structured interview guide led the current research.

Data Analysis: Data analysis began with coding of the information gathered from the available sources, which provided a general structure. A frequentative process was implemented to identify key words, phrases, and categories. After the cases had been coded by the interviewers, three scholars examined the data following a systematic and supportable approach described by Krueger & Case. Researchers reviewed the questions prompted by the interviewers along with the transcripts, concentrating on one question at a time while considering the overall purpose of the research.

The rural communities were coded as “Community A” and “Community B”. While analyzing the responses, priority consideration was given to words used and the meaning of the words, the context and specificity of responses. Themes were identified by frequency of repeated phrases and key words. Common themes such as “parental example and time (lack of)” were rampant throughout the transcriptions. Tables were then developed for each objective in order to examine the difference between the common themes in the 2 two communities.

RESULTS AND DISCUSSION

This section presents the case study findings and discussions on how children develop an interest in what they eat, how they make healthy eating food choices, what are unhealthy food examples, what are the barriers to healthy eating, and the differences between these communities based on the responses from the participants in this study.

The participants in this study indicated numerous factors associated with how children developed an interest in what they ate (see Table 2). One of the participants stated: “Our kids like finger foods, they like it more if it’s something they can pick up.” Another participant indicated stated that: “...color is a big thing for him (referring to her child) if he can pick out colors and sometimes if its little things he can count he will sit there and start eating....” Overall, however, the researchers noticed that the participants generally agreed that children were interested in consuming foods that were appealing and what children often saw advertised on television or what they saw in their environment (e.g., fast food and parental examples at homes). In addition, it was generally agreed that parents should encourage their children to eat healthy and provide better food choices.

<table>
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<tr>
<th></th>
<th>Finger foods</th>
<th>Colorful food</th>
<th>Following parent’s example</th>
<th>Little countable food</th>
<th>Food that looks fun and appealing</th>
<th>Encouraging/urging better food choices</th>
<th>Encouraging/urging better eating habits</th>
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<td>1</td>
<td>Finger foods</td>
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When the participants were asked about the healthy food choices they would like to add to their children’s meals, they generally agreed on fruits, vegetables, submarine sandwiches, and organic foods (see Table 3). The participants in these rural communities clearly indicated that they were aware of healthy food choices. Consequently, they were asked if there were any foods they would remove from meals? The answers were not too surprising. The participants generally agreed to remove starchy carbohydrate, sugary treats, junk foods, and processed foods (see Table 3). Even though their responses were
not surprising, it was interesting to know that these communities had a notion or understanding of healthy food choices. However, their communities were still plagued with the consumption of foods they believed to be unhealthy for their children.

<table>
<thead>
<tr>
<th>Healthy Food Choices</th>
<th>Unhealthy Food Choices</th>
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<tr>
<td>1 Fruits and vegetables</td>
<td>Federal level that needs to be changed</td>
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<tr>
<td>2 Sub Sandwiches (e.g., Subway)</td>
<td>Starchy carbohydrate</td>
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<tr>
<td>3 Potatoes and corn</td>
<td>Sugary treats (e.g., cookies or candies)</td>
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<tr>
<td>4 Fresh salad</td>
<td>Junk food (e.g., fast food and fried foods)</td>
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<tr>
<td>5 Organic foods</td>
<td>Bacon</td>
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<tr>
<td>6 Vegetables</td>
<td>Processed foods</td>
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</table>

Table 3: Healthy food choices for children.

When the participants were asked about how children developed an interest in healthy eating, they generally agreed on starting children eating healthy at a young age through access to healthy food, encouraging/urging children to eat healthy, exposure to healthy food, and parents setting good examples by eating healthy (see Table 4). Even though the participants believed that parents should urge their children to eat healthy, some of the participants indicated that it was not easy to accomplish this particular objective. One of the participants stated: “My husband will bring home the candy bars, the cookies and the sodas and I’m like hide it from the four-year olds because they will want it…” This was a challenging issue for many people in various communities. It was not easy for the parents, school, or daycare authorities to tell them to eat healthy while what the children saw advertised on television, practiced at home, or displayed in their environment was encouraging them to eat and drink in a way contrary to healthy eating habits.

| 1 Access to healthy food |
| 2 Modeling after parents healthy choices |
| 3 Exposure to healthy food |
| 4 Encouraging/urging children to eat healthy |
| 5 They have to see you eat it |
| 6 Hide it (unhealthy food) from the four year olds |
| 7 Starting them young |
| 8 Parents setting a good example |

Table 4: Children interest in healthy eating.

Bearing the above in mind, it was obvious that these communities had a good knowledge of what healthy and unhealthy foods were and how to help children develop an interest in healthy eating habits. However, based on the results of the interviews, it was clear that some members of these communities were still faced with the challenges of healthy food consumption. For example, one of the participants stated: “I should remove fried foods, but they just taste too good, I don’t know if I want to.” When the participants were asked about the barriers to healthy eating, they generally agreed that there were different barriers associated with different communities and community members due to a variation in the socioeconomic conditions of the families in these communities. Some of the generally accepted responses in regard to barriers to healthy eating included: 1) lack of income for healthy eating, 2) lack of educational inspiration for healthy eating, 3) unaware of the importance of healthy eating, 4) unhealthy stuff is cheaper, 5) healthy eating is expensive, 6) more exposure to unhealthy alternatives, (e.g., advertising and fast food places), 7) too busy (no time) to eat right, 8) not home to cook or too tired, 9) too many commitments. Hence, going for convenience (i.e., fast food) was a big motivator for unhealthy eating (see Table 5). It was interesting to learn that it was very challenging to inspire some of the community members to attend free healthy eating education seminars in their communities. One of the participants stated: “It seems like everywhere, you have trouble getting people to come for education. You know we had trouble with people coming to schools, we’ve offered things in the community. I think…you can offer all the classes you want but it’s hard to get them to read a pamphlet, come to a class, or a demonstration. I think we would all be rich and famous if we knew how to get them all to come, we could go on the road and market that.”

| 1 Lack of income for healthy eating |
| 2 Lack of educational inspiration toward healthy eating |
| 3 Not aware of the importance of healthy eating |
| 4 Unhealthy stuff was cheaper |
| 5 Healthy eating was expensive |
| 6 A lot of exposure to unhealthy alternatives (advertising, television, and fast food places) |
| 7 Too busy (no time) to eat right |
| 8 Not home to cook or too tired |
| 9 A lot of commitments |

Table 5: Barriers to healthy eating.

The frustration of this participant was very clear in the participant’s comment. This particular factor showed that even though the communities were offering incentives for healthy eating education, the incentives were not enough to motivate some members of these communities to attend free healthy eating education seminars.

The results of this study also suggested that parents and/or guardians in these communities seemed too busy to create time for healthy eating habits. One of the participants stated: “A lot of parents have 2-3 kids who have ball games so they pick them up after work and fast food is all they have. My brother has 3 kids and all 3 play ball they’re never home till 10 p.m. and they’ll stop wherever they’re at or what town their playing in. It’s just fast paced they’re not home to cook or they’re too tired when they get home.” Another participant indicated that: “...convenience is big, we live in a fast paced society where we need convenience...they eat out 3/4th (75%) the time because
they’re coming home from a ball game or something.” This particular issue seemed to be one of the most challenging obstacles to healthy eating habits in these communities. It was not farfetched to assume that families in rural communities should have more time to cook and eat together because they were not overwhelmed with the hassles and bustles of big cities. Unfortunately, the result of this study was contrary to these perceptions. The findings indicated that in an attempt for the community members to find fun activities or entertainments, the community members attended activities that exposed their children to unhealthy eating habits. One of the participants stated: “Sometimes it’s hard to serve dinner with a lot of commitments going on. Very busy in the evenings and people eating on the go.” Similarly, another participant affirmed this barrier by stating that: “I think that as much as anything has done it, because everyone is going different directions. I admire the family that takes the time to sit down with their children and eat and talk. You’ll see that development later in life with the children, because they will indeed grasp that too.”

Despite the impact of different commitments that led many community members to eat junk food (e.g., fast food and fried foods), the participants in this study also agreed that lack of adequate income was another major barrier to healthy eating habits. One of the participants stated: “Cheap foods...bad foods of families in this community are, then you are purchasing (bad foods)...because it’s cheaper.” The participants generally agreed that even though they were aware of the importance of fruits and vegetables toward healthy eating habits, fruits and vegetables (especially the fruits) were very expensive.

Differences between Communities A and B

Some of the differences between Community A and B are shown in Table 6. A noteworthy difference was the percentage of overweight and obese children in both communities. The findings indicated that Community B children were more overweight and obese. The researchers were very interested in knowing why there was a large gap in the rate of overweight and obese children in these communities. The demographic profiles of both communities were very similar except in regard to the “per capital income” and “White alone” population, which were higher in Community A. In addition, Community A had active Food Corps and Health Coalition groups that focused on promoting healthy eating habits in the community. Another major difference between these communities was that Community B had a higher rate of “Hispanic” population. These differences seemed to be the major factors associated with Community B’s overweight and obese children. Regardless of the causes of Community B’s overweight and obese children, it was very obvious to the researchers that the impact of Community A’s Food Corps and Health Coalition groups could not be undermined. The major focus of these groups were to curtail the prevalence of obesity in their community and enhance healthy eating habits.

Table 6: Differences between community A and B.

<table>
<thead>
<tr>
<th>Profiles</th>
<th>Community A</th>
<th>Community B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>2,381</td>
<td>2,785</td>
</tr>
<tr>
<td>Male</td>
<td>47.0%</td>
<td>40.5%</td>
</tr>
<tr>
<td>Female</td>
<td>53.0%</td>
<td>59.5%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>8.8%</td>
<td>49.7%</td>
</tr>
<tr>
<td>White alone</td>
<td>85.4%</td>
<td>46.1%</td>
</tr>
<tr>
<td>Asian alone</td>
<td>2.3%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Two or more races</td>
<td>1.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Black alone</td>
<td>0.6%</td>
<td>0.3%</td>
</tr>
<tr>
<td>American Indian alone</td>
<td>0.8%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Per capita income</td>
<td>$16,105</td>
<td>$14,599</td>
</tr>
<tr>
<td>Median resident age</td>
<td>31.3 years</td>
<td>29.1 years</td>
</tr>
<tr>
<td>Median gross rent</td>
<td>$570</td>
<td>$588</td>
</tr>
<tr>
<td>Rate of overweight + obese high school children</td>
<td>25.0%</td>
<td>52.5%</td>
</tr>
<tr>
<td>Rate of overweight + obese intermediate school children</td>
<td>27.0%</td>
<td>49.7%</td>
</tr>
<tr>
<td>Rate of overweight + obese elementary school children 1</td>
<td>18.6%</td>
<td>39.4%</td>
</tr>
<tr>
<td>Rate of overweight + obese elementary school children 2</td>
<td>21.7%</td>
<td>N/A</td>
</tr>
<tr>
<td>Food Corps</td>
<td>Very active</td>
<td>Inactive</td>
</tr>
<tr>
<td>Health Coalition</td>
<td>Very active</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

CONCLUSION AND IMPLICATIONS

This case study suggested that healthy eating habits in children was not as easy as simply telling children to eat healthy. It required a conscientious effort on the part of the parents and/or guardians in urging the children to eat healthy. In addition, if parents and/or guardians wanted their children to eat healthy, they needed to show good examples of healthy eating behaviors at home. Children have photographic memories and they are very good at doing what they see their parents/guardians do. It should be noted that if children are to develop healthy eating habits, parents/guardians should start the children at an early age eating healthy foods before they develop their taste buds for unhealthy food choices.

This study also had implications for the communities. Even if the parents and/or guardians were showing good examples of healthy eating behaviors at home, what about the children’s experiences with junk food in their communities? One of the participants whose family members were regulars at ball games stated: “...they could provide healthy food in the concession stands, I spent a large part of my life in concession stands with kids in ball games, and you know the cheese dip, the pretzels, hot dogs...your taste buds are adapted to that, it would be nice where there would be healthier choices...” Bearing the above in mind, community leaders should be thinking of some modalities to enhance the food choices or provide healthier choices in their community events.
The findings also indicated that even though parents and/or guardians were aware of healthy food choices, many were faced with the challenges of providing healthy food choices to their children. Some of their major challenges included: too busy (no time) to eat healthy and the lack of adequate income to eat healthy. These challenges seemed to be a commonality in the two studied communities. One of the major implications of these challenges was that parents and/or guardians should be cognizant of the importance of creating time for healthy eating. Hence, if parents and/or guardians want their children to adapt to healthy eating habits, they must create time for healthy eating. In addition, the community leaders (especially in rural communities) should embark on some modalities to support underprivileged families to help secure healthy food choices. For example, they should work with local schools or colleges to provide government funded or discounted healthy meal options for the underprivileged members in their community.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study, like many other studies, was not without limitations. The credibility and reliability of a qualitative research was highly dependent on triangulation for enhancing the validity of the study. This study was designed with various forms of validity and reliability in the research phase. However, the researchers wished they had been able to involve authors who did not participate in gathering the data for the data analysis phase of the research. The researchers felt this would be beneficial in curtailing the potential researcher’s bias in regard to data analysis and would heighten the reliability of the generated data. In addition, the researchers wished they could have studied more communities to corroborate the findings from these two communities.

This study provided a logical report regarding the challenges of healthy eating habits in rural communities. Additional research is needed to include additional rural communities in order to know if the findings from these communities can be supported in other rural communities. In addition, future research should also focus on urban communities and examine the differences between the challenges in rural and urban communities. Furthermore, future studies should also explore the importance of a community health coalition in the promotion of healthy eating habits.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Obesity and Trace Elements

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Obesity has been identified as a medical problem. Obesity may be associated with abnormal metabolism and micronutrient deficiencies. Thus, obesity and malnutrition at the same time is a reality. However, in the past it was unusual to say that people who eat much were liable to be malnourished. Now-a-days, eating too much does not mean meeting nutritional requirements. This is due to the fact that several factors affect those requirements; as nature of diet, dietary habits, food preparation and host-related factors as intestinal absorption.

Trace elements are of great value in regulation of normal body metabolism, as they interact with many enzymes and hormones; some of which will be discussed.

MAGNESIUM

It is the second most abundant intracellular cation, approximately 50% of total body magnesium is found in bones. The other 50% is found inside cells of body tissues and only 1% is found in blood. Magnesium is essential for absorption and utilization of nutrients; carbohydrates, fats and proteins. It is a critical cofactor for hundreds of enzymes especially those involved in glucose metabolism and a direct antagonist of intracellular calcium. Moreover, it is associated with insulin sensitivity. As hypomagnesaemia results in reduced insulin sensitivity of peripheral tissue through reduced auto-phosphorylation of tyrosine kinase, a component of the β-subunit of the insulin receptor for which magnesium is a co-factor. Also, hypomagnesaemia may be associated with reduced β-cells proliferation and thus affecting insulin production. Therefore, serum magnesium levels are negatively correlated with Insulin Resistance (HOMA-IR).

The exact mechanism of hypomagnesaemia in obese patients is unclear but may be related to eating habits; as increased intake of carbonated soft drinks, which are rich in phosphorous and thereby interfere with magnesium absorption, or increased intake of caffeine resulting in increased magnesium excretion. Another mechanism may be increased intake of dairy products with high Ca+ content and or fat content thus interfere with its absorption.1

IRON

Iron is essential co-factor; it is a constituent of a number of important macromolecules, including those involved in energy production, Deoxyribonucleic acid (DNA) synthesis and metabolism. On the other hand, iron can be dangerous being a catalyst of free radical reactions. Because of this dual nature, iron balance is tightly regulated. Most of iron in body is incorporated to heme biosynthesis in erythropoietic bone marrow and other heme containing enzymes, the remaining amount is found in hepatocytes and cells of reticuloendothelial system.

Obesity may promote iron deficiency through inhibition of dietary iron absorption from the duodenum. Under normal conditions, iron absorption is dependent on both a divalent metal transporter and the iron exporter Ferroportin (FPN). FPN is regulated by hepcidin. The liver derived peptide hormone hepcidin is the primary regulator of iron hemostasis; which is both an inhibitor of intestinal iron absorption as well as macrophage iron release. In the
intestines hepcidin exerts its effect by binding to iron exporter ferroportin (FPN) leading to FPN phosphorylation, degradation and decreased iron absorption. Also pro-inflammatory cytokines secreted from adipose tissue in obese subjects stimulate hepcidin release from adipose tissue. In addition, these cytokines as Interleukin 1 (IL-1) and Interleukin 6 (IL-6) may interfere with erythropoietin hormone secretion, and blunt the erythroid precursor response to the hormone.²

Moreover, lipocalin 2, an iron binding protein is produced by adipose tissue and could lead to sequestration of iron stores making them unavailable for hemoglobin or myoglobin formation. Over-secretion of these proteins (hepcidin and lipocalin 2) leads to increased iron content in adipose tissue, thus preconditions for adverse effects of local iron overload; as iron is capable of inducing oxidative stress, inflammation and adipose tissue endocrine dysfunction. Thus, obesity is associated with both elevated body iron stores and iron deficiency. Resultant iron deficiency and anemia may impair mitochondrial and cellular energy homeostasis and further increase fatigue of obese subjects.²

**ZINC**

It is an important element in DNA synthesis, gene expression and activity of various enzymes and maintenance of normal growth. It plays a critical role in integrity of the immune system and wound healing. It is also found to enhance synthesis, storage and release of insulin. Zinc deficiency has been reported in obese subjects. However, the exact mechanism is unclear. It may be due to Zinc accumulation in the adipose tissue, as result of increased adipokines production, increased Leptin production. They induce chronic inflammation and expression of metallothioein and Zinc-Copper transporter in hepatocytes. These proteins result in accumulation of these metals in hepatocytes and adipose tissue and decreased serum concentration.³ Decreased serum Zinc concentration in obese patients plays a role in insulin resistance.

**COPPER**

Most of absorbed dietary copper is transported to hepatocytes, which utilize it for their metabolism as respiration due to its role in cytochrome oxidase function at the mitochondrial electron transport chain and free-radical defense being anti-oxidant. Serum Copper levels were reported to be significantly higher in obese patients compared to normal body weight controls. Some authors reported a negative correlation between serum Copper and High-density lipoprotein (HDL)-cholesterol.⁴

The mechanism for its elevation in obese patients is unclear but it is thought to be due to pro-inflammatory cytokines released from adipose tissue as IL-1 enhance intra-cellular Zinc accumulation with intra-cellular Copper efflux, and when released to blood it binds to Ceruloplasmin. High serum copper and low serum zinc were associated with increased cardiovascular mortality.⁵

Copper imbalance often results in a reduced desire for protein, especially animal protein. Also high tissue copper aggravates obesity. It is always associated with high serum leptin. In addition, its excess tends to raise tissue sodium levels while lowering tissue potassium levels. High sodium level subsequently results in water retention. Low potassium results in hypoglycemia and sweet cravings.⁶

**CHROMIUM**

Chromium is considered an essential ultra-trace metal. Once absorbed from intestines, it is distributed to various organs of the body, especially the kidney, muscle, and liver. The principal carrier protein is transferrin, which plays a critical role in the movement of chromium from blood to Low-molecular-weight chromium (LMWCr); oligopeptide low-molecular weight (LM) chromium (LMWCr)-binding substance (MW ~1,500 Da). Thereby amplifies the intracellular insulin signal. Therefore, chromium is an active factor in the substance; Glucose Tolerance Factor (GTF). It enhances the tyrosine kinase activity of the insulin receptor and, which makes insulin more effective. Thereby controlling carbohydrate and lipid metabolism. Its deficiency is associated with high level of pro-inflammatory cytokines as Tumor necrosis factor alpha, Interleukin 6 and C-reactive protein (TNF-a, IL-6 and CRP), high lipids levels and oxidative stress. However, Chromium supplementation cannot reverse diabetes if occurred, but it inhibits glycation process which is responsible for many of diabetes complications.⁶

Factors affecting chromium deficiency; include advanced age, diet rich in fat, milk and other high phosphorus foods tend to bind chromium to make chromium phosphates which are not absorbed through the intestines.⁷

**SELENIUM**

It is an essential trace element and is a key component of several selenoproteins required for normal health as Glutathione peroxidase. It plays an important role as an anti-oxidant, especially when combined with vitamin E. It is also essential for thyroid function and regulation of the immune system.

Selenium is generally well absorbed in the intestines; mostly in duodenum; some in the jejunum and ileum. Absorption is enhanced by the presence of other antioxidants, such as vitamins E and C. After absorption, it is transported by Low Density Lipoproteins and Very Low Density Lipoproteins (LDL and VLDL), where it is stored in muscle, as well as in other organs, as the liver, kidney, and pancreas.⁸

It has been reported that serum selenium is significantly lower in obese patients. Its deficiency is associated with
increased oxidative stress and impaired thyroid function; since type I iodothyronine 5'-deiodinase is a selenium containing enzyme. This enzyme is essential for production of active thyroid hormone tri-iodothyronine. However, the exact mechanism of its deficiency in obese patients is unclear; it may be due to decreased anti-oxidants. Also dietary antioxidants enhance selenium absorption. In addition, they are critical for maintaining and replenishing the overall antioxidant capacity of the body.9

Its deficiency is associated with increased risk of infection, atherosclerosis cardiomyopathy and myopathy, also thyroid fibrosis and irreversible hypothyroidism, if Se deficiency limits peroxide destruction by the protective action of Glutathione peroxidase.8

In conclusion; the bioavailability of trace elements may be disturbed in obese patients, and the exact prevalence of this alteration is still unknown. Deficiency of Serum Magnesium and Copper are inversely related to body weight and Body Mass Index (BMI). Disturbance of trace elements are associated with metabolic syndrome. Dietary supplementation is not the solution; also bariatric surgery may aggravate the deficiency in some conditions. Controlled weight reduction should be considered with extreme care.

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