

Determinants of Dietary Behaviors of School Going Adolescents in Sudan

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Abstract

Background: Healthy dietary behaviors are acquired during adolescence and track into adulthood. To promote dietary behaviors of adolescents, studying the predisposing and enabling factors that are associated with dietary behaviors is indispensable.

Objectives: This study investigates the relationship between dietary behaviors and attitudes as predisposing factors, and availability and affordability of foods as enabling factors of young adolescents, in the context of a developing country facing instability (i.e. Sudan).

Methodology: A cross sectional self reported questionnaire survey was conducted among 800 students (43.6% Boys and 56.4% Girls), aged 10 to 15 years from 26 basic schools in Omdurman and Khartoum North Localities in Khartoum State.

Results: Multivariate linear regression showed that gender was a significant predictor for the intake of all food groups, except dairy products (fruits and vegetables, energy sources and proteins). There were considerable positive associations between affordability and availability, and the intake of all four food groups, but upon that, food intake was also positively associated with attitudes in terms of liking, particularly among boys.

Conclusions: The findings suggest a remarkable influence of predisposing and enabling factors on the dietary behaviors of adolescents in basic schools. Therefore, actions towards feasible interventions in schools, to enhance balanced dietary behaviors of young adolescents, are mandatory.

Keywords: Dietary behaviors; Schools; Young adolescents; Sudan

Introduction

Dietary behaviors are vital throughout adolescence, as this period is characterized by intense growth [1]. Balanced diet during adolescence promotes optimal health, growth and intellectual development [2]. The WHO pronounced that adolescence is a period for the adoption and consolidation of sound dietary habits, especially since healthy dietary behaviors are acquired during adolescence and track into adulthood [1,3].

Nutritional needs during adolescence are increased because of the increased growth rate and changes in body composition associated with puberty [4,5]. The dramatic increase in energy and nutrient requirements coincides with other factors that may affect adolescents' food choices and nutrient intake, and thus, nutritional status. Other factors, including the quest for independence and acceptance by peers, increased mobility and greater time spent at school, and/or work activities, and preoccupation with self-image contribute remarkably to the erratic and unhealthy dietary behaviors that are common during adolescence [4,6]. However, changes that occur during early adolescence age and puberty due to hormonal changes may influence the dietary behaviors, and were referred to as sex-biased psychopathologies [7].

Gender has also been found to be associated with dietary behavior of adolescents [8,9]; a review by Rasmussen et al. [10] revealed that girls have a higher or more frequent intake of fruits and vegetables than boys. In study done by Ritva Prattalla about gender differences in consumption of meat, fruit and vegetables in Scandinavian and Baltic countries, the result showed that Women's diets are healthier than men's. Finnish women eat more fruits and vegetables, but less meat than men. Gender differences may be larger in the Baltic countries, which represent Eastern European transition societies than in Finland, a society characterized by the Scandinavian welfare ideology and a high degree of gender equality.

In Sudan, knowledge about adolescents' nutrition and health is scarce. Obviously, many Sudanese adolescents are faced with poverty, which affects their ability to afford food items; also, availability of food is of concern in some areas where natural disasters forced more than four millions of the Sudanese population to become internally displaced [11]. Moreover, political instability is beginning to have alarming consequences for the general population, as well as for young people. Therefore, it is highly important to study the nutritional status and related behaviors of adolescents, in the context of a developing country facing instability, which might affect their dietary behaviors.

Although the main contemporary nutritional problems in the world are obesity and its consequences, the epidemics of malnutrition still subsist in developing countries [3,12]. However, most of the studies in developing countries examined associations of dietary behaviors, in terms of eating patterns and food intake with physical status, rather than addressing the determinants of dietary behaviors. Research conducted among Sudanese adolescents in Khartoum State illustrates anaemia, malnutrition, healthy and unhealthy dietary behaviors within this group [13,14].

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In order to effectively promote nutritional behaviors of adolescents, or to intervene to correct nutritional problems, it is necessary to describe the dietary behaviors and their determinants [15]. According to Green and Kreuter [16], a systematic need assessment has to be considered first in planning health promotion programs [17]. For the purpose of the present study, a conceptual model of the dietary behavior of school going Sudanese adolescents aged 10 to 15 years was composed of adapted elements and conceptions of the PRECEDE framework [16], the Theory of Planned Behavior (TPB) and the Social Cognitive Theory [18].

In this context, the model considers the intake of foods from four food groups, energy source foods, fruits and vegetables, protein rich foods and dairy products, as the relevant behavior. Predisposing factors in the model include attitudes, which reveal the propensity of the individual to respond positively or negatively to a certain behavior. Personal liking of a food determines the individual's decision to eat a particular food [19]. Proxy for attitudes towards dietary behavior is the degree of liking of a food item that is commonly consumed in Sudan (e.g. affective basis of attitude). Presumably, attitudes are also based on the beliefs of the individual, with regard to the consequences brought about by the behavior (e.g. cognitive basis of attitude) [20]. Therefore, the perceived importance of specific foods to the wellbeing of the body is a predisposing factor for the performance of dietary behavior. Both measures of attitude (i.e. liking and perceived importance) are interacted by enabling factors, i.e. affordability and availability of food products, which finally lead to the desired dietary behaviors. Desired behaviors might also be affected by barriers such as the standard of living [19].

The study was based on a need assessment for planning interventions to improve and promote the dietary behaviors of Sudanese young adolescents. Also, the study inclined to furnish a baseline data through a cross sectional survey about young adolescents' dietary behaviors. Hence, we have not restricted ourselves to a specific theory or conceptual framework. But, the conceptual framework we developed was a simplified multidisciplinary model that combined several concepts to serve the purpose of investigating the dietary behaviors of our population, before planning the intervention (Figure 1). Subsequently, we employed some elements of the PRECEDE model, as a diagnostic step to portray factors that shape the dietary behaviors of young adolescents, and lend a hand in planning interventions. Additionally, PRECEDE model generates objectives and criteria for evaluation, such as predisposing factors, which were considered substantial to include mainly attitudes of young adolescents and their perception or belief about the importance of food items commonly

used in Sudanese diets. The other elements used were the enabling factors, which were indicated by the availability and affordability of food items to our population and their households. These predisposing and enabling factors were mentioned in phase 4 of the PRECEDE model. The behavior of food consumption was included in phase 3 of the model. The idea behind incorporating some concepts of the Theory of Planned Behavior was the expediency in identifying and collecting information from a target group, before the program is developed. Therefore, we emphasized in attitudes towards eating food groups' behavior, and the other factor was the perception about the importance of food to the body, which led to the performance of the behavior. Moreover, we assimilated some concepts from the Social Cognitive Theory, such as the environmental factors (availability and affordability of foods by the participants, and their households).

The study model assumes that predisposing factors such as attitudes are related to the intake of fruits and vegetables, energy food sources, proteins and dairy products. The impact of these predisposing factors on dietary behaviors was expected to be moderated by enabling factors in the form of economic and physical factors (i.e. affordability and availability).

Methodology

Study design and population

This cross-sectional study was conducted in two localities of Khartoum State (Omdurman and Bahri). The participants included in the study were 800 school-going adolescents aged (10-15) years; 349 (43.6%) boys and 451 (56.4%) girls, selected using a multi-stage sampling procedure controlling for geographical distribution (2 localities) and type of school (private or public). A systematic random procedure was used to select students from the attendance sheet of the classes (grades 4 to 8), from 26 selected public and private schools, in total, in the study areas. However, the theoretical sample size based on the precision in systemic sampling, with a 5% risk error, and calculated according to the expected malnutrition prevalence estimated as fraction of 1(50% malnutrition, FAO, WHO, 1990), and a precision or systemic sampling of 95% with a 5% risk factor.

Data collection

The data was collected using a structured questionnaire taken by trained interviewers. The questionnaire was sectioned to provide basic demographic and socioeconomic status, predisposing and enabling factors regarding food intake and dietary behaviors.

Measurements

Demographic and socio-economic status: Gender, age and standard of living index (SLI) were the variables selected to reflect the demographic and socio-economic status. The SLI was constructed from 10 items, including both parents' educational level, availability at home of electricity, television, telephone, bathroom, kitchen, refrigerator, availability of tap water and possession of a car [21,22]. Principal component analysis (PCA) on the 10 items showed a one-factor solution. A factor score for SLI was constructed with a Cronbach's alpha of .81.

Predisposing factors: Predisposing factors were measured in terms of *liking* of each of 18 food items (fruits, vegetables, red meat, chicken, fish, milk, milk products, eggs, legumes, kissra (indigenous sorghum bread), bread, fast foods, cakes/biscuits, doughnuts, confectionary, juices, soda drinks and tea), and in terms of *perceived importance* of

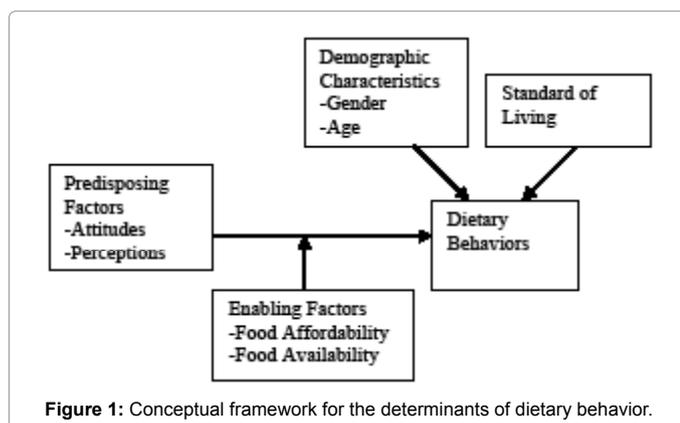


Figure 1: Conceptual framework for the determinants of dietary behavior.

these food items. Liking of the food items was measured on a four-point scale (like, neither like nor dislike, dislike, and do not know). A mean score was calculated for the four food groups, namely fruits and vegetables (fruits, vegetables, fresh fruit juices) energy source foods (cereals, confectionaries, fatty foods and soft drinks), proteins source foods (meats, legumes, eggs) and dairy products (milk, milk products). Secondly, perceived importance was measured by providing the participants a checklist of the 18 food items, asking for the level of importance of the named food item to their bodies. A four-point scale was presented, which was ultimately dichotomized into two categories, a score '1' for perceiving the food item as "important" and a score of '0' for "neither important nor unimportant", "not important" and "do not know" scored. Again, a mean score was computed for each of the four food groups.

Enabling factors: *Availability and affordability* of foods were the variables measuring the ability to acquire food. For the 18 food items described above, participants had to indicate whether the item was available or not, and whether it was affordable or not. By affordability, we meant that food items are purchasable for a reasonable price by the participants and their household. This was explained to the participants by the interviewers. In the questionnaire, there were four answering possibilities for the availability items, as well as for the affordability items, which were transformed into two categories. The answer "available" was scored '1'; "unavailable", "sometimes", and "do not know" were combined into one category as '0', "not available". Similarly, the answering category "affordable" was scored as '1'; "unaffordable", "sometimes", "not affordable", and "do not know" were combined into one category (and scored as '0'), for each variable a mean score was created for each of the four food groups.

Dietary behaviours: Participants in this study provided information on the average frequency of consumption (un-quantified for weight) of the 18 food items over the previous week, by selecting one of seven frequencies ranging from "never" to "every day more than once a day". The food list aimed to cover the most commonly consumed foods among adolescents in Khartoum state.

The scores in each of the 18 food items were recoded into an estimation of the daily frequency of consumption. Recoding was done as follows: in order to approach a ratio scale: everyday more than once (1=1.5), once a day (2=1), 5 to 6 days a week (3=.79), 2 to 4 days a week (4=.43), once a week (5=.14), less than once a week (6=.07), never (7=0), doesn't know (8=0). The 3 missing values were treated as zero. Subsequently, additive sum scores were calculated indicating the four food groups: the energy source foods group score was composed of 8 different food items, containing mainly high carbohydrates and fats. Fruits and vegetables group encompassed 5 foods items or drinks, mainly rich in fresh fruits and vegetables. The protein group included 6 foods items and drinks containing high protein value. The dairy group comprised 3 items, mainly milk and milk products.

Data analysis

Statistical analyses were conducted using SPSS, version 17.0. Descriptive statistics were calculated to describe means and standards deviations for boys and girls. Gender differences in dietary behaviors, predisposing (attitudes measures) and enabling factors (availability and affordability) of foods were analyzed using independent samples student t-test. Linear regression was employed to test for associations between gender, age, attitudes (both liking and perceived importance), availability and affordability of foods as predictors for outcome variables, which were dietary behaviors classified into four food groups scales. Next, tests for association between the predisposing factors and the outcomes when moderated by the enabling factors were executed, separately for the four food groups. The statistical significance was set at $P < 0.05$.

Results

Table 1 shows the overall intake of fruits and vegetables, energy foods sources, proteins and dairy foods and drinks groups, among school going adolescents 10-15 years old.

Girls showed a higher daily mean intake of fruits and vegetables

	Total sample (n=800)	Boys (n=349)	Girls (n=451)	P-value ^a
Fruits/Vegetables intake	3.34 ± 1.36	3.18 ± 1.34	3.46 ± 1.37	<.004
Liking fruits and vegetables	.66 ± .16	.68 ± .14	.65 ± .17	<.001
Perception of the importance of fruits and vegetables for the body	.63 ± .18	.63 ± .18	.64 ± .17	NS ^b
Affordability of fruits and vegetables by the household	.65 ± .19	.64 ± .20	.65 ± .19	NS
Availability of fruits and vegetables in the household	.50 ± .23	.51 ± .23	.50 ± .23	NS
Energy foods intake	7.60 ± 2.72	7.37 ± 2.77	7.78 ± 2.68	<.036
Liking energy foods	.77 ± .22	.79 ± .21	.75 ± .22	<.008
Perception of the importance of energy foods for the body	.65 ± .29	.66 ± .30	.64 ± .28	NS
Affordability of energy foods by the household	.83 ± .19	.84 ± .20	.83 ± .19	NS
Availability of energy foods in the household	.65 ± .26	.66 ± .26	.65 ± .26	NS
Protein foods intake	3.64 ± 1.96	3.54 ± 2.02	3.72 ± 1.92	NS
Liking protein foods	.70 ± .25	.75 ± .23	.65 ± .26	<.000
Perception of the importance of protein foods for the body	.69 ± .28	.72 ± .27	.67 ± .29	<.029
Affordability of protein foods by the household	.72 ± .29	.72 ± .29	.71 ± .29	NS
Availability of protein foods in the household	.51 ± .31	.52 ± .32	.50 ± .30	NS
Dairy products	1.67 ± .82	1.71 ± .82	1.64 ± .81	NS
Liking dairy products	.47 ± .23	.52 ± .21	.44 ± .24	<.000
Perception of the importance of dairy products for the body	.54 ± .19	.55 ± .18	.54 ± .20	NS
Affordability of dairy products by the household	.55 ± .19	.55 ± .19	.54 ± .20	NS
Availability of dairy products in the household	.49 ± .22	.50 ± .22	.48 ± .22	NS

^aP-value for differences between boys and girls

^bNS=Not significant

Table 1: Means and standards deviation of dietary behaviors for fruits and vegetables, energy food sources, proteins and dairy products and the predisposing and enabling factors.

than boys. In this study, boys reported more positive attitudes towards fruits and vegetables compared to girls.

There was no significant difference between boys and girls, regarding their belief in the importance of fruits and vegetables to the wellbeing of the body. Girls reported higher intake of energy food sources than boys. Positive attitudes towards eating energy food sources were reported more by boys than girls. Mean daily intake of proteins by boys and girls did not differ significantly, while liking the intake of protein foods was reported more by boys than girls. Boys reported a stronger belief in the importance of protein to the body than girls. Intake of dairy products was more reported by boys than girls. Attitudes of boys towards the intake of dairy products were significantly higher than girls. No variation between boys and girls, with regard to their perception about the importance of dairy products. There was no difference between boys and girls regarding affordability and availability of any of the four food groups.

The model of this study assumed that the effects of predisposing factors on dietary behaviors were moderated by enabling factors, but the independent variables were highly correlated; multicollinearity resulted when the interaction terms were incorporated. With the elimination of interaction terms, Tolerance values extended from low (.685) to high (.988), and the Variance Inflation Factor (VIF) values ranged from 1.012 to 1.460. Based on the cut-off points for determining the presence of multicollinearity as Tolerance value less than .10 and VIF value of about 10; the interaction terms were excluded from the final model [23].

Table 2 shows multivariate linear regression results, the model entered to test for associations between the four food groups and demographic variables, standard of living, predisposing and enabling factors.

The regression model for fruits and vegetables indicated that all independent variables taken together account for 20.7% of the variance of intake of fruits and vegetables. Intake of fruits and vegetables was higher among girls and adolescents who scored higher in liking fruits and vegetables, perceived importance of fruits and vegetables, and greater affordability and availability of fruits and vegetables.

Regarding the energy food source group, all predictors explain 16.4% of the variance in intake of energy food products. Girls consumed more energy food group than boys. While liking energy food products, perceived importance of energy food, affordability and availability of energy foods were reported more by boys compared to girls. Liking, perceived importance of energy food products, Affordability and availability of energy foods had a positive influence on their consumption.

Attitudes towards protein foods intake differ significantly, whereas boys reported more liking and better perception about the importance of proteins to body. The model for protein intake explained 17.6% of the total variance in intake. Gender was positively associated with protein intake, as our study revealed that girls consumed slightly more protein foods than boys. Perceived importance of proteins foods to the body was positively related to their consumption. Affordability and availability of protein-containing foods were significant predictors for the intake of protein foods.

Dairy products were more favored by boys compared to girls. For dairy products, the model explained 18.1% of the variance in intake. Association between intake of dairy products and liking of dairy products was a significant predictor for actual intake of dairy products. Furthermore, perceived importance of dairy products to the body also predicted the intake of dairy products. Affordability and availability of dairy products in the household were highly significant predictors for the intake of dairy products.

Age was not a predictor for any of the dietary behaviors. SLI was positively correlated with affordability ($r = .13$ to $.22$ for the four food groups) and availability ($r = .11$ to $.28$) of the food items in the household, but it did not contribute to the intake of the different food groups. Liking the foods and perceived belief of the importance of the four food groups to the body were positively correlated ($r = .29$ to $.44$).

Discussion

This study investigated predisposing and enabling factors that determine the dietary behaviors of adolescents in Sudan, a developing country facing instability. The findings showed considerable association of the enabling factors of food acquisition (affordability and availability), with the consumption of all four food groups. Since, dietary intake is influenced by the food being physically affordable and available; our findings correspond with our assumption in considering these enabling factors as direct determinants of dietary behaviors of adolescents, as proposed in the conceptual model described in the Introduction section.

The finding in this study revealed that gender contributes as influential predictors for the consumption of energy food supply and proteins, whereas girls consume more of these food items compared to boys. This finding contradicts with the findings in a study conducted in Nigeria [24].

In addition to the relatively positive predictive influences of gender and attitudes of participants in this study, the perceived affordability and availability of foods were also influential predictors for the entire intake of all food groups. Surprisingly, the SLI did not contribute to as additional prediction of food intake. A relatively high level of

Predictors ^a	Fruits/Vegetables group	Energy group	Protein group	Dairy group
Gender	.116***	.108***	.069*	.013
Age	-.005	.001	-.033	-.059
Standard of Living	.051	.043	-.065	.044
Attitudes in terms of liking the food group	.104**	.185***	.054	.240***
Attitudes in terms of perceiving the importance of food group to the body	.092**	.130***	.087**	.071*
Affordability of the food group by the household	.166***	.112**	.155***	.155***
Availability of the food group in the household	.267***	.157***	.302***	.166***
R ²	.207	.164	.176	.181

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

^aStandardized beta weight reported

Table 2: Multivariate linear regression analysis for fruits and vegetables, energy, protein, and dairy intake among adolescents' boys and girls living in Khartoum State.

under-nutrition was reported in a recent study, high prevalence of underweight (67.6%), anemia (65.0%) and Bitot's spots (13.1%), among the same population of adolescents [25]. This indicates that for a substantial part of this population, adequate nutritious food is not available and not affordable. These findings are also in line with the conclusions from a recent national food and nutrition security survey in 2009, which showed undernourishment among 33% of the Sudanese population [26]. This high level of under-nutrition may negatively affect adolescents' overall health, cognitive development and school performance [1,2].

Another aspect that may contribute to the dietary behaviors of young people in our study is the lack of food equity, as a cultural norm in Sudan prescribes that older people, and particularly males, are prioritized in food serving. This norm was expressed by the adolescents in our study, who sometimes stated that the food is not available or affordable, since it has not been provided to them.

In essence, the study revealed significant statistical relationships between attitudes in liking and consumption in all 4 food groups, particularly among boys. These preferences correspond with their perception about the importance of food to their bodies, except with the perceived importance of fruits and vegetables. In spite of the positive attitude of liking fruits and vegetables by boys, girls consume more fruits and vegetables compared to boys. This finding may be attributed to the perception of girls about the importance of fruits and vegetables to the body [10]. Unfortunately, we could not test whether enabling factors moderated the relationship between predisposing factors and dietary behaviors, because of multicollinearity. However, this study reveals that perceived importance and likeability of food groups have added value in explaining dietary behaviors over and above enabling factors. Although the paucity of dietary behaviors studies in developing countries constrains comparison with previous studies, this shows that predisposing factors are even important within the context of a developing country facing instability. Therefore, future intervention initiatives should target both students (e.g. within school curricula) and higher ecological levels (e.g. addressing affordability and availability).

Limitations

The cross-sectional nature of this study warrants future research, investigating whether the associations still hold in longitudinal studies. Furthermore, qualitative research can provide more in-depth insight as part of a need assessment regarding adolescents' dietary behaviors, and reveal other determinants that might contribute to explaining variance in adolescents' dietary behaviors.

Conclusions and Implications

The findings indicate that multiple predisposing and enabling factors influence dietary behavior among adolescents. The use of these findings in the development and implementation of nutrition education interventions may assist in the promotion of balanced dietary behaviors among both genders of adolescents. Facing the fact that girls consumed more fruits and vegetables, which is regarded as a healthy behavior; boys should equally be encouraged to consume more fruits and vegetables, as they were having a positive attitude towards this food group.

Schools are appropriate settings for interventions, since they provide a fertile ground to promote balanced dietary behaviors at the proper ages, to secure healthy growth and built up a strong immune system to resist diseases. In addition, balanced dietary behaviors of students help students in maintaining school attendance and performance.

It is fundamental to introduce a multidisciplinary approach to combine health and nutrition subjects within the schools' curriculum. Hence, a demand for a comprehensive curriculum to address nutritional themes, such as food science and hygiene, demonstrations of food preparation and food production to include food gardening; such programs will raise the awareness of adolescents towards the importance of food and nutrition, as well as, to the importance of cultivation and the financial revenues, particularly in a poor country like Sudan. Schools may need a call for stakeholders and involvement of parents to collaborate in projects that promote food security measures. Furthermore, schools' canteens should be regularly checked to ensure the provision of balanced healthy meals and snacks. Availability of subsidized nutritious foods at schools may persuade adolescents to improve their dietary behaviors. Moreover, a strategy would be to involve students to conduct periodical healthy food corners at schools and to restrict unhealthy foods (soda drinks, potato crisps, and many other salty and fatty foods). Although this study has provided baseline findings, further qualitative and longitudinal studies are required to articulate the determinants of adolescents' dietary behaviors, as to accomplish the suggested interventions.

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