MACHINE LEARNING BASED EATING BEHAVIOR IDENTIFICATION OF STUDENTS USING K-MEANS CLUSTERING

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ABSTRACT

Identification of unhealthy eating patterns are a significant public health problem with recent economic and health consequences. Although many dietary preferences are formed early, the transition to independent living during the university years is a significant event because as people mature, they become more capable of making their own eating decisions. This study's objective was to use a questionnaire to assess eating patterns in relation to students' sociodemographic factors. One hundred students completed matched questionnaires describing pronounced snack intake, eating intentions, and a healthy diet. This study looks at how women and babies should eat, and it uses Google Docs to describe and analyze the facts about food intake. Through examining the content of documents pertaining to eating behavior, particularly with regard to fruits, milk, vegetables, and fast food, a series and evaluation of information has been provided. The findings of this investigation may be utilized to make recommendations regarding how to measure students' drinking habit in relation to their health using IBM SPSS Statistics 21.0's machine learning based k-means cluster evaluation.

KEYWORDS– C*onscious, Questionnaire dataset, Behavior Identification, K-means clustering, SPSS.*

1. INTRODUCTION

Extra nutrients and strength are provided by a meal. In addition to the nutrients found in food, other chemicals are also present and their effects on health are also becoming more recognized. The relationship between foods, vitamins, and dietary habits has important ramifications, particularly for the prevention and development of chronic diseases like diabetes, cancer, chronic breathing illnesses like chronic obstructive pulmonary disease, and cardiovascular diseases like heart attacks [2]. Food options continue to evolve throughout life as a result of biological, social, and environmental influences. These possibilities are important influencers of food preferences and, consequently, diet.

Since this is the best time in a child's life to introduce healthy eating habits and dietary advice that will benefit them in the future and also improve the general fitness of a girl infant as well as the future adult population, puberty is the ideal time to make dietary decisions and implement changes as a result. During this time, a new set of weight-related behavioral patterns

including excessive alcohol intake and poor levels of physical activity start alongside bad food habits.

Although breakfast is thought to be the most significant meal of the day, gender seems to have a big impact. The survey tool used to gather data was a 20-item nutrition questionnaire, which not only included the aforementioned socio-demographic factors but also a series of multiple-choice and open-ended questions that assessed different eating habits of the students, in terms of the type and frequency of the food consumed. The poll was voluntary for students to take part in, and all replies were kept confidential.

2. LITERATURE OVERVIEW

One of the key activities that may have a negative impact on young adults' weight status and, as a result, adults' future health is physical inactivity and bad eating habits [3,7].Recent years have seen research on eating behavior in kids [17], teens [18,19], and young adults [20], although theories to explain such behaviors are still in the early stages of development [21]. Internalizing and practicing daily healthy eating habits are also necessary for maintaining a healthy diet. Due to this, the analysis that follows concentrates on the impact that age and gender identity play in aiding or impeding. Because of their poor eating habits, college students who have trouble sleeping may find it difficult to succeed academically. Short-sleepers were shown to have a five-fold higher risk of exhibiting abnormal eating behaviors than long-sleepers in a study evaluating the connection between habitual sleep duration and eating disorders in students (Hicks and Rozette, 1986). In terms of both health and health care costs, poor nutrition and obesity are two of society's most pressing health challenges today (Goel, 2006; Rashad & Grossman, 2004).

Taste, cost, nutrition, convenience, enjoyment, and weight control are the top determinants of adult food choice, according to several studies (Glanz, Basil, Maibach, Goldberg, & Snyder).This research looked at avoiding dieting, eating and exercising, and diabetes pupils, in that order. The current study offers important new knowledge on how students' eating habits are influenced by their health beliefs—a demographic that is crucially moving to independent nutritional practices.

Numerous research has indicated that unhealthful eating habits are common among students. Students typically consume fewer daily servings of fruits and vegetables and report eating a lot of high-fat, high-calorie items (Brevard & Ricketts, 1996; Driskell, Kim, & Goebel, 2005; Racette, Deusinger, Strube, Highstein, &Deusinger, 2005).Inadequacies in several areas, such as diet A, nutrition D, foliate, zinc, and diet B12 shortages [9]. The bulk of these research have shown that a vegetarian diet mostly consists of fruits, legumes, vegetables, and cereals, with occasional additions of dairy, eggs, and meat. Contrarily, cluster analysis classifies people into dietary groups based on similar patterns of meal consumption. Additionally, cluster evaluation supports the use of both continuous and specific variables [17].

3. EXPERIMENTAL RESEARCH METHODOLOGY

In order to develop a nutrient-specific intervention, we decided to look at the dietary preferences of baby girls in light of the aforementioned gaps. Obesity is the biggest concern for pupils. Teenagers who attend school want to be in good physical shape. Children who go to school typically want to become more conscious of healthy eating practices. The chief minister of Tamil Nadu, MK Stalin, introduced a free breakfast program for government primary school kids as part of an intervention to promote maternal, baby, and nutrition. The present observation was used as a component of the formative assessment to explain this initiative. The nutrition plan was created based entirely on research showing that the majority of children suffer from nutritional inadequacies.

3.1 SIGNIFICANT EATING BEHAVIORS AMONG STUDENTS

3.1.1 Family Dinners

Both parents and children find solace in the routine of eating meals together. Family meals are predictable for youngsters, and parents get an opportunity to catch up with their children. Children who participate in regular family meals are also more likely to consume grains, fruits, and vegetables. Less inclined to indulge in unhealthy snacks. Additionally, family meals give parents a chance to model good eating for their children and introduce them to new cuisines. Teenagers may object to the idea of a family lunch, which is understandable given their hectic schedules and desire for independence. However, research shows that teenagers still want their parents' counsel and assistance, so use mealtime as an opportunity to catch up with them. Additionally, try the following suggestions:
  •   Let youngsters bring a friend to dinner
  •   Involve your child in meal planning and preparation.
  •   Avoid giving lectures or getting into arguments during mealtime.

3.1.2 Buy Healthy Foods in Bulk

Children, especially smaller ones, will typically consume anything is in the house. Controlling the supply lines—the items you provide for meals and keep on hand for snacks—is crucial for this reason.
•   Incorporate at least five servings of fruits and vegetables into the daily schedule. Every meal should include fruit or veggies. By keeping fresh fruits and vegetables on hand and ready to eat, you may make it simple for students to select healthy snacks.
•   Serve lean meats and other high-quality sources of protein, such as fish, eggs, beans, & nuts.
•   Other healthy snacks include low-fat yoghurt, peanut butter and celery, or whole-grain crackers and cheese.

3.1.3 Avoid Fights Over Food

It is simple for disagreement to arise over food. Parents with the best of intentions may find themselves bartering with or paying children to eat the nutritious food that is put in front of them. Giving kids some control but simultaneously limiting the kind of foods available at home

is a healthier approach. Children must determine their own level of hunger, what they will consume from the available options, and when they are satisfied. In between meals as much as during meals, parents have influence over what foods are provided to their children. Following are some suggestions:

Create a dependable routine for your meals and snacks. When parents and kids are aware of when the next meal or snack will be served, choosing not to eat is acceptable.
- Avoid making children clear their plates. Kids learn to ignore feelings of fullness by doing this.
- Avoid rewarding or bribing children with food. Do not provide dessert as a reward for eating the meal.
- Avoid using food to express your love. Give youngsters a hug, some of your time, or encouragement when you want to demonstrate your love.

3.1.4 Include children

The majority of children will love selecting the dinner menu. Discuss making decisions and preparing a balanced dinner with them. Some might even want to participate in the dinner preparation and ingredient shopping. Parents must remember to provide their children natural sources of energy like coconut milk, avocado, dry seeds, millets, and whole wheat instead of ice cream and junk food if their children are involved in sports and other outside activities. Additionally, it's crucial to maintain a nutritional balance and bear in mind the overall nutritional value of food consumed in place of best calorie requirements. Teenagers who stop following a healthy diet plan may have a variety of health issues in their early 20s. Parents must instill a healthy eating habit in their children from a young age. They ought to teach their child the benefits of eating vegetables and the final result. Develop strategies to encourage young adults to adopt healthy eating habits.

3.2.RESEARCH TECHNIQUE
3.2.1   Clustering

Clustering is the most difficult component of intense study in numerical fields such as statistics, sample recognition, and device mastery. This questionnaire survey focuses on clustering in data mining. Statistics mining offers a solution to the issues brought on by large datasets with different attributes of diverse types. This in turn puts a special computational burden on related clustering techniques. A recent expansion of algorithms that have been successfully applied to resolve real-world data mining challenges has satisfied these conditions. Two-step clustering, k-means clustering, and hierarchical cluster analysis are the three clustering methods provided by IBM SPSS statistics. Use the IBM SPSS data-step method when you have a substantial data set or a combination of continuous and categorical variables.

3.2.2 K-Means Clustering
Each case is represented by the cluster that is closest to the cluster mean according to the k-means method. The necessary number of clusters is K. The search for the k-means is the method's main objective. After a foundational set of methods has been defined, scenarios are

categorized according to how far away from the centers they are. The cluster means are then determined once more using the cases that were assigned to the cluster. Then, using the most recent set of techniques, reclassify each scenario once more. If necessary, carry out this step again until there is little fluctuation in the cluster means between steps. Once the cluster means have been recalculated, the cases are subsequently assigned to their default clusters.

4. Experimental Methodology
4.1 SPSS BASED RESULT EVALUATION

Statistical Package for the Social Sciences is the name of the IBM SPSS Statistics programme, also known by the acronym SPSS. It is a piece of software for statistical data analysis. Despite the name of the programme referring to its early usage in the social sciences, SPSS has been applied to other data markets. built software that runs on Windows. SPSS can be used to enter, analyze, and visualize the data. All of the analyses presented in this chapter, as well as many more, may be performed using SPSS, which can manage vast amounts of data. A working knowledge of SPSS should be helpful given that it is commonly used in both the social sciences and the commercial world. SPSS is the best software for learning data management statistics.

Data management procedures generally consist of three steps:

- Importing data into the SPSS Package
- Labelling data (variables and values);
- Sorting and merging data.

Step 1: Click Start All Programs IBM SPSS Statistics 21.0 to start the SPSS application.
Step 2: After automatically presuming that it should open an existing file, SPSS provides a dialogue window to ask which file would like to open.
Step 3: Select "More files..." in the current dialogue box to navigate to the location where we previously saved our dataset for the EATING BEHAVIOR.
Step 4: Once found the file, click **Open** and display.
Step 5: Another window appeared, generally blank but with some strange-looking text in it.
Step 6: Normally collect data, to categorize our new variable into: Fresh fruit, Milk, Vegetables and fast food and then change the type is String into Numeric defines the variable view of dataset.
Step 7: Defines the data view of data set and then convert all strings to numeric data.

Step 8: Now interpreting the results use any clustering techniques.

Step 9: Select Analyze → Classify → K means cluster.

4.2 K-MEANS CLUSTERING

The process is known as k-Means, where k is the necessary number of clusters, and the goal is to assign a case to the cluster analysis for which its distance from the cluster mean is the least. The main objective of the set of rules is to find the k means. Cases are initially grouped according to how close they are to the centers. The cluster manner should then be computed once again

using the cluster's cases. Reclassify every instance using the updated set of criteria. Repeat this step if the cluster strategy doesn't dramatically alter between steps. The cases should be assigned to their permanent clusters and the cluster means should be updated at some time.

4.2.1 Start Cluster Centers

The initial stage in k-Means clustering is finding the k means facilities. This is accomplished through iterations. To lessen the trade between two iterations, start with a fundamental set of centers and then tweak them as necessary. In any other circumstance, you could let IBM SPSS data find k well-separated cases and use those numbers as initial clustering facilities. Table 1 displays the early resources for the female infant's good eating habits.Once the first cluster centers have been selected, each case is subsequently assigned to the closest cluster based on its proximity to those centers. After each case is assigned to a cluster, the cluster facilities are updated based on all of the instances in the cluster. Once more, these cutting-edge cluster centers are used for case assignment. Assign instances to them, then move the cluster centers about until either no centers shift significantly, or the allotted number of iterations (10 by default) has been used.

Table1: Initial Cluster Centers

	Cluster		
	1	2	3
FRESHFRUIT	4	2	1
MILK	1	1	2
VEGETABLES	1	1	2
FASTFOOD	4	1	4

4.2.2   History of Iterations

Three iterations were sufficient for the data in Table 2. Table 2 lists three iterations and changes to cluster centers.

Table 2: Iteration History

Iteration	Change in Cluster Centers		
	1	2	3
1	1.743	.801	1.022
2	.067	.022	.026
3	.003	.001	.001
4	9.915E-005	1.581E-005	1.596E-005
5	3.814E-006	4.273E-007	3.991E-007
6	1.467E-007	1.155E-008	9.977E-009
7	5.641E-009	3.122E-010	2.495E-010
8	2.171E-010	8.536E-012	6.336E-012
9	8.445E-012	3.279E-013	2.555E-013
10	4.215E-013	1.067E-013	1.037E-013

The maximum number of iterations was completed, hence the iterations ceased. The convergence of iterations failed. Any centre can experience an absolute coordinate shift of no more than 4.122E-013. Ten is the current edition. The shortest separation between original centres is 3.317 miles.

4.2.3 CLUSTER MEMBERSHIP
Table 3 displays the cluster membership of each cases and distance between each cluster.

Table 3: Cluster Membership

Case Number	AGE	Cluster	Distance
1	18 - 20 Years	1	1.430
2	18 - 20 Years	2	1.206
3	18 - 20 Years	3	1.048
4	15 - 18 Years	1	1.812
5	15 - 18 Years	3	0.798

4.2.4 LAST CLUSTER CENTERS
When an iteration is complete, all cases are grouped based on the closing set of cluster centres. Once all the instances have been grouped, the cluster facilities are calculated once every time. Describe the clusters using the newest cluster infrastructure. The median fruits proportion of Cluster 1 in Table 4 is much higher than that of the other clusters. While the costs for milk, vegetables, and fast food are all typical, the values for milk in Cluster 2 are above

average. Fast food and fresh fruit are both above average in cluster 3, while all of the other components have below-average levels.

Table 4 : Final Cluster Centers

	Cluster		
	1	2	3
FRESHFRUIT	4	1	2
MILK	1	2	1
VEGETABLES	1	1	1
FASTFOOD	2	1	4

4.2.5 STATISTICS USING ANOVA

If there are values that are outliers, case plot the distances to their cluster values for each case, as shown in figure 1.
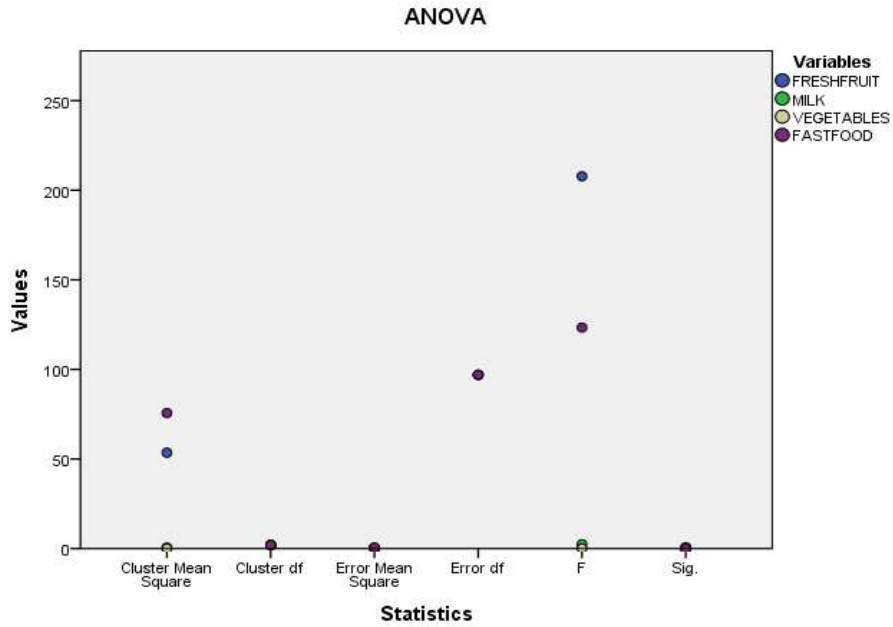

Figure 1: Statistics using ANOVA

Fresh fruit had the highest preference among students according to an analysis of variance (ANOVA), followed by fast food, milk, and vegetables with the lowest preference.

5. CONCLUSION

The majority of kids, according to this poll, have eating issues such finicky eating, partial eating, overeating, etc. Using the SPSS Package, we conducted this survey to identify the healthy eating habits of girl students. We also wanted to raise awareness of these students' preferred foods and their good eating habits. The survey questionnaire uses K means cluster approaches. After computing the findings, they are displayed in such a way that fresh fruits or fresh fruit liquids may be consumed first. second, a preference for quick food. Only 51% of

young girls regularly consume milk, making it their third choice. Finally, the least harmful eating practise is to include veggies in all of your meals.

6. REFERENCES

[1] **Birch LL, Fisher JO**. Development of eating behaviors among children and adolescents.

[2] **Schachter S.** Obesity and eating. Internal and external cues differentially affect the eating behavior of obese and normal subjects. Science 1968.

[3] **Patton GC, Sawyer SM, Santelli JS, Ross DA, Afifi R, Allen NB,** et al. Ourfuture: a Lancet commission on adolescent health and well-being. Lancet. (2016) 387:2423–78.

[4] **Leroy JL, Ruel M, Sununtnasuk C, Ahmed A.** Understanding the determinants of adolescent nutrition in Bangladesh. Ann NY Acad Sci. (2018)

[5] **Andrew L, Thorne-Lyman SS, Mehra S, Wu LSF, Ali H, Alland K,** et al. Dietary patterns of >30,000 adolescents 9-15 years of age in rural Bangladesh. Ann NY Acad Sci. (2019)

[6] **Mehra S, Dharal S, Sharma S**. Investing in our adolescents: assertions of the 11th world congress on adolescent health. J Adol Health. (2018) .

[7] **Keats ECR, Rappaport AI, Shah S, Oh C, Jain R, Bhutta ZA.** The dietary intake and practices of adolescent girls in low- and middle-income countries: a systematic review. Nutrients. (2018).

[8] **International Institute for Population Sciences (IIPS) and ICF.** National Family Health Survey (NFHS-4), 2015-16: Mumbai: IIPS (2017).

[9] **Ministry of Health and Family Welfare (MoHFW) GoI,** UNICEF and Population Council. Comprehensive National Nutrition Survey (CNNS) National Report. Ministry of Health and Family Welfare (MoHFW) GoI: New Delhi (2019).

[10] **Cespedes EM, Hu FB.** Dietary patterns: from nutritional epidemiologic analysis to national guidelines. Am J ClinNutr. (2015).

[11] **Daniel CR, Prabhakaran D, Kapur K, Graubard BI, Devasenapathy N, Ramakrishnan L,** et al. A cross-sectional investigation of regional patterns of diet and cardio-metabolic risk in India. Nutr J. (2011)

[12] **Venkaiah K, Brahmam GNV, Vijayaraghavan K**. Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations. J Health PopulNutr. (2011)

[13] **Joy EJ, Green R, Agrawal S, Aleksandrowicz L, Bowen L, Kinra S**, et al. Dietary patterns and non-communicable disease risk in Indian adults: secondary analysis of Indian Migration Study data. Public Health Nutr. (2017) 20:1963.

[14] **Kehoe SH, Krishnaveni GV, Veena SR, Guntupalli AM, Margetts BM, Fall CH,** et al. Diet patterns are associated with demographic factors and nutritional status in South Indian children. Matern Child Nutr. (2014).

[15] **Green R, Milner J, Joy EJM, Agrawal S, Dangour AD**. Dietary patterns in India: a systematic review. Br J Nutr. (2016).

[16] **Hearty Á, Gibney** M. Comparison of cluster and principal component analysis techniques to derive dietary patterns in Irish adults. Br J Nutr. (2008).

[17] **Benassi M, Garofalo S, Ambrosini F, Sant'Angelo RP, Raggini R, De Paoli G**, et al. Using two-step cluster analysis and latent class cluster analysis to classify the cognitive heterogeneity of cross-diagnostic psychiatric inpatients. Front Psychol.

[18] **Ou, X.M. (2002) Evaluation on kindergarten health education.** J. Educ. Sci. Hunan Normal Univ.

[19] **Lin, Z.P., Zhang, J.Y., Liao, H.Z., Pan, B.J. (2003)** The investigation on child dietary behaviors and its influence factors in Fuzhou, China. Strait J. Prev. Med.,

[20] **Jiang, P.H., Yu, X.H., Nie, Y.K.** (2018) Analysis on child dietary behavior problems and
family factors. J. Mod. Med. Health,

[21] **Shi, Z., Mo, B.Q.** (2013) Study of the malnutrition status of pre-school children and related influence factors in Nanjing, 2012. Jiangsu J. Prev. Med.,

[22] **Liu, Y., Geng, Y.M., Zhu, Y.C.** (2017) Chinese "Dietary Guideline for Residents" evolution and enlightenments. Sichuan Sports Sci.,