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**UTILIZATION OF NUTRITION INFORMATION ON FOOD LABELS BY
DIABETIC MELLITUS AND HYPERTENSIVE PATIENTS ATTENDING CLINIC
AT KAKAMEGA COUNTY TEACHING AND REFERRAL HOSPITAL, KENYA**

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ABSTRACT

The aim of food labels is to inform consumers on the food content. The information conveyed on food labels has evolved over time thus the objectives of food labelling have become numerous. Despite the recognized association of food labels utilization and disease management, the current global mortality rate from *diabetes mellitus* and hypertension remains high. In order for the prevalence rate of *diabetes mellitus* and hypertension to reduce, population-wide interventions including the promotion of healthy diets through the provision of adequate information on food labels should be done. This study aimed at assessing utilization of nutrition information on food labels by diabetic mellitus and hypertensive patients. This was a cross-sectional study conducted in March and April 2022 at Kakamega County Teaching and Referral hospital, Kenya. Data was collected from respondents using a structured questionnaire administered to 125 randomly selected respondents and the response rate was 80%. Socio-demographic characteristics of the study participants were determined using descriptive statistics for distribution. Association between the study variables was determined using Chi-square test. Statistical significance was set at $p<0.05$. The analyzed data was presented by use of frequency tables, graphs and pie charts. About 46% of the respondents were aged >60years. About 73% were married and about 40% reported to have completed primary education level. About 39 % were self-employed earning less than Ksh. 5,000 (50 USD) per month. Prevalence of diabetes and hypertension in Kakamega were at 4.6% and 29.4% respectively. Age ($p= 0.028$), Education ($p= 0.001$), Job/employment ($p=0.0010$), Monthly income ($p=0.001$) and Monthly household food expenditure ($p=0.007$) significantly influenced utilization of food labels. About 64% ($n=64$) reported to be knowing what food labels are and about 34% ($n=34$) reported not knowing what they are. About 46.8% ($n=30$) of those who reported they read the labels participants reported that they read nutrition information every time they purchased the product, 37.5% ($n=24$) read the information the first time they purchased the product and 15.7% ($n=10$) read nutrition information on food labels at other different times. Food prices, nutrition information on the food label, health and nutrition status and fat/sodium/sugar content were among the factors that had a high influence on utilization of food labels. This study recommends nutrition education to the general population on benefits of reading nutrition information on food labels in order to make healthful food choices in order to reduce the prevalence of these chronic diseases.

Key words: Food labels, Utilization, Nutrition, *Diabetes mellitus*, Hypertension, Kakamega



INTRODUCTION

Diabetes mellitus and hypertension are the leading causes of morbidity and mortality globally, and disproportionately affecting low- and middle-income populations [1]. Currently, *diabetes mellitus* and hypertension cause over 63% of global deaths, with 80% of these occurring in developing countries such as Kenya [2]. The World Health Organization (WHO) predicts that by 2030, *diabetes mellitus* and hypertension will cause 73% of global deaths and 60% of the disease burden [1]. The increasing burden of *diabetes mellitus* and hypertension in developing countries has been associated with unhealthy diets [1, 3]. These conditions are largely preventable, with up to 80% of premature deaths from *diabetes mellitus* and hypertension being preventable through evidence-based interventions [4, 5].

Diabetes mellitus and hypertension are conditions of public health concerns globally that are associated with a significant burden of disease, incapacities and deaths [6]. The social and economic impact of these conditions on the economy is significant, as they result in increased health needs, lost productivity, premature deaths, financial burden and poverty [2, 3]. Population-wide interventions, such as the provision of adequate nutrition information on food labels, are essential to prevent, control and manage *diabetes mellitus* and hypertension [6, 7]. Nutrition labels have been shown to encourage healthier diets choices among people who read and utilize them [4, 9].

Despite this, prevention and control of non-communicable diseases (NCDs) such as *diabetes mellitus* and hypertension often receive inadequate attention, particularly in sub-Saharan Africa where both NCDs and communicable diseases are highly prevalent [10]. By 2030, deaths from *diabetes mellitus* and hypertension in African nations are projected to exceed the combined deaths from communicable, nutritional, and maternal diseases [11]. Kenya, like most developing countries, is facing a double burden of communicable and non-communicable diseases [12]. *Diabetes mellitus* and hypertension remain the leading causes of death in Kenya in terms of absolute numbers and Disability-Adjusted Life Years (DALYs) [13].

According to the United States Department of Agriculture Continuing Survey (DACS), nutrition information on food labels has been found to have a positive impact on consumers. The survey found that reading nutrition information on food labels decreased caloric intake from total fat by 6%, saturated fat by 2.1%, and cholesterol by 67.6 mg, and sodium by 29.6 mg [14]. Those who read the food labels often use them to compare products and find out how much fat and calories the food contains, leading to more healthful diets [4, 15, 16]. However, the effectiveness of nutrition information on labels in improving sub-Saharan African



dietary patterns depend on a motivated and educated public to make healthful choices [17, 19].

In developed countries, nutrition information on labels has become a significant policy tool for promoting healthy eating habits [20]. The Nutrition Labelling and Education Act of 1990 (NLEA) in the United States gives the Food and Drug Administration (FDA) the authority to require nutrition information on food labels [21]. The regulations of NLEA have been implemented in Europe, the Middle East, Asia, and Africa [22]. The goal of NLEA regulations is to make nutrition label information more useful for consumers and to increase consumer welfare [22]. In response to the growing demand for healthy foods, nutrition information on the food label has become mandatory in many countries, reflecting consumers' right to know the content and nutrition information of food products they purchase and consume [23]. The increased prevalence rate of diabetes to 3.3% and hypertension to 24.7% in Kenya may explain why sodium, cholesterol, and fat are the most commonly used nutrition information items on the food label [24]. High consumption of these nutrients is associated with NCDs and various types of cancers [25]. In addition, the notable increase in nutrition-related NCDs highlights the importance of providing clear and informative nutrition information on food labels to consumers.

In Kenya, Kenya Bureau of Standards (KEBS) ensures that food production methods are of the optimum degree of order for common and repeated use [26]. This includes terminology, symbols, packaging, marking, and labeling requirements as they apply to a product, process, or production method. Standards serve to ensure that products and services are fit for their purpose and are comparable and compatible. Additionally, the government of Kenya has developed the food and nutrition security policy, which places nutrition at the center of human development in the country [26].

There is limited literature on the utilization of nutrition information on food labels by patients with *diabetes mellitus* and hypertension in sub-Saharan Africa at large as majority of the studies have been conducted in developed countries leaving behind the developing countries. It is, however, important to understand the relationship between good nutrition and proper utilization of nutrition food labels as this might help in managing and controlling of these conditions [27]. This study aimed at identifying factors influencing utilization of nutrition information on food labels by patients with *diabetes mellitus* and hypertension attending clinic at Kakamega County Teaching & Referral Hospital



MATERIALS AND METHODS

Study Area

The study was conducted at Kakamega County Teaching & Referral Hospital (KCTRH). The hospital is a level 5 government health facility, which is located along Kisumu-Kakamega Road. The facility is a lifeline for the residents of Western region as it serves as the main Public Referral hospital for Kakamega County as well as neighboring counties including Vihiga, Bungoma and Busia. The hospital is located in Kakamega County which is the fourth populous county after Nairobi, Kiambu and Nakuru and is cosmopolitan hosting people from other regions and counties according to a report by the 2019 Kenya Population and Housing Census. The 2019 Kenya National Bureau of Statistics reported that *diabetes mellitus* affects 3.3% while hypertension affects 24.5% of the population in Kakamega County [28]. The hospital was purposively selected because it is the county's only public health facility of level 5 and the only Teaching and Referral hospital with a comprehensive clinic for patients with *diabetes mellitus* and hypertension in Kakamega County.

Study Design

The researchers adopted descriptive cross-sectional design to collect quantitative data. Researchers adopted this study design in order to achieve the study's objectives and, therefore, findings could be generalized to populations and counties with similar characteristics to those of the study population.

Population

The study population were patients with both *diabetes mellitus* and hypertension aged 18 years and above, attending clinic at Kakamega County Teaching and Referral Hospital (KCTRH).

Sampling strategy and Sample size

A sample size of 125 was calculated using Fisher *et al.* [41] formula. The participants with *diabetes mellitus* and hypertension were selected using systematic random sampling. Systematic random sampling allowed the researcher to sample participants from a larger population, from the sampled population, the sample interval was calculated by dividing the population size by the desired sample size (p) which was 125 and the (n th) value was 5, which eventually gave the researcher the representative intervals of those to participate in answering the questionnaires without having to reach out to each and every one of them. This method ensured that every eligible individual had an equal chance of being included in the study.



Response Rate

A total of 125 participants consented to participate in the study. However, only 100 participants completed the questionnaires. The study encountered a loss of 25 participants during the data collection process. The reasons for this loss were as follows: 15 participants withdrew their consent due to personal reasons (such as not having time for the interview despite consenting), 5 participants were excluded due to missing data or incomplete questionnaires, 5 participants became critically ill before the interview. Therefore, our final sample size was 100 participants. The response rate of this study was at 80% and any response rate above 60% is still considered adequate [42].

Inclusion criteria

The study's inclusion criteria were patients with both *diabetes mellitus* and hypertension, both male and female aged 18 years and above, attending outpatient clinic and given consent to take part in the study.

Exclusion Criteria

Dissenting persons, patients with only *diabetes mellitus* or patients with only hypertension and critically ill patients were excluded from the study.

Data collection methods

Primary data on socio-demographic characteristics of patients with both *diabetes mellitus* and hypertension were collected using a structured questionnaire. Data on factors influencing utilization of nutrition information on food labels by the research participants were also collected using a structured questionnaire.

Data management and analysis

The data collected were entered, coded, cleaned and analyzed. Quantitative data for socio- demographic characteristics of patients with *diabetes mellitus* and hypertension were summarized and analyzed in Statistical Package for Social Sciences (SPSS) version 26. Chi-square test was performed to test the association between utilization of nutrition information on food labels and factors influencing utilization of nutrition information on food labels by patients with both *diabetes mellitus* and hypertension. Statistical significance was set at $p<0.05$. The analyzed data were presented by use of frequency tables, graphs and pie charts for ease interpretation.

Logistical and Ethical considerations

An ethical approval to conduct the study was obtained from Masinde Muliro University of Science Institutional Research and Ethics Committee with approval number MMUST/IERC/031/2021. A research license was obtained from National Commission for Science, Technology and Innovation with license number NACOSTI/P/21/14425. Permission to conduct the study was obtained from the



Ministry of Health, Kakamega County Teaching and Referral Hospital (KCTR). The researchers obtained written consent from the individual patients with *diabetes mellitus* and hypertension attending clinic at KCTR to participate in the study voluntarily and those who did not accept to participate were not coerced/discriminated against in any way. All the respondents had equal chances of being selected to participate in the study upon meeting the criteria for selection. During the study, all the respondents were treated equally and fairly throughout the study regardless of their religion, age, their position, social status in the community. Information collected was kept securely and confidentiality was maintained throughout the study. The data collected did not have any personal identifiers as unique codes generated by the researchers were assigned to each participant. No harm was done to the respondents as the research was non-invasive.

RESULTS AND DISCUSSION

The study found out that 60% (n=60) of the respondents were female and 40% (n=40) were male. Findings of this study indicated that of the respondents 46% (n=46) were above 60 years of age. The study found out majority of the respondents 73% (n=73) were married. Regarding religion 94% (n=94) were Christians. Regarding level of education completed, the study found that 40% (n=40) had completed primary. The study findings indicated that about 37% (n=37) of the respondents earned a monthly income of less than Ksh.5000. About 39 % (n=39) of the respondents reported to be self-employed. The findings also indicated that 38% (n=38) of the respondents' monthly household food expenditure was below Ksh.5,000 as summarized on table 1.

The respondents were asked if they were able to read nutrition information on food labels and the findings indicated that 37% (n=37) of females read the nutrition information as compared to males at 27% (n=27). The findings of this study indicated that people aged above 60 years read the nutrition information on food labels less as compared to those below 60 years. Age ($p=0.028$), education ($p=<0.001$), job/employment ($p=0.001$), monthly income ($p=0.001$), and monthly household food expenditure ($p=0.007$) significantly influenced utilization of nutrition information of food labels as summarized on Table 2.

This study agrees with other studies that suggests that females are more likely to use nutrition information on food labels than males [30]. A study by Post *et al.* [9] on patients with hypertension, diabetes mellitus, or hyperlipidemia, contrary to these results showed that those who were advised by a nutritionist/dietitian to reduce intake of calories or fat are 50% more likely to use nutrition information on food labels regardless of gender [9]. The findings of this study are contrary to Julia



et al. [36], who found out that men in general are more likely to read nutrition information on food labels than women.

The findings of this study show that age influenced the decisions of patients with *diabetes mellitus* and hypertension on reading nutrition information on food labels. Similar to this study, other studies show that age plays a critical role in food choices especially in old age [18]. Contrary to the findings of this study, another study found that age did not influence food choices and subsequently reading of nutrition information on food labels [31].

Previous studies have reported a positive relationship between the level of education and food label use, even though Nayga et al. [45] found no evidence supporting this relationship. Darkwa [42]; Grunert et al. [33] found out that education level affects utilization of nutrition information on food labels [33, 42]. This study finding is consistent with Wiles et al [44] who reported that individuals with higher education levels are more likely to read nutrition information on food labels than those with low education level [44].

According to a study by Kim and Lee [29], income level influenced how consumers perceived and used the nutrition information on food labels in South Korea. The study found that consumers with higher income levels were more likely to use the nutrition information on food labels than those with lower income levels. The study also suggested that income level may interact with other factors, such as level of education, health status, and dietary habits, to influence the utilization of nutrition information on food labels [29]. The findings of this study are consistent with some previous studies that have reported a positive relationship between income level and the use of nutrition information on food labels [45]. However, other studies have found no significant effect between level of income and use of nutrition information on food labels.

Factors influencing utilization of nutrition information on food labels

The participants were asked about factors influencing utilization of nutrition information on food labels and the findings of this study indicated that for those who read the labels price 62.6% (n=41) significantly influenced reading of nutrition information on food labels. In terms of health and nutrition status, 48.0% (n=30) of the respondents reported that health and nutrition status are influential, 29.0% (n=19) of the participants reported that the brand of the product was influential when reading the nutrition information on the food label, In terms of the taste of the product 28.0% (n=18) reported that the taste was influential, about 23.7% (n=15) of the respondents said that taste was very influential and about 48.4% (n=31) said taste was not influential at all. Lastly, about 41.7% (n=27) of the respondents



reported that fat/sodium/ sugar content was influential to them when reading the food label as summarized on fig 1.1.

The findings on time spent on utilization of nutrition information on food labels in this study agreed with studies by Drichoutis *et al.* [45] and Lin and Lee *et al.* [29] who reported that reading and use of nutrition information on food labels takes more time than what consumers can spend, and therefore, people are less likely to use the nutritional information on the food label. The findings of this study indicate that price was very influential in utilization of nutrition information on food labels. This agrees with a study by Løvhaug *et al.* [38] who also found that price was a very influential factor influencing utilization of nutrition information on food labels [38]. This study finding was in contrast with findings of Shahid *et al.* [43] who found out that price was not an influential factor influencing utilization of nutrition information on food labels [43]. The type of nutrition information on the food label is an important aspect in food choices and food label use. In this study type of nutrition information on food label was very influential and this study agrees with a study done by Melo *et al.* [39]. Health and nutrition status of individuals was also found to be influential in food label use and this study agrees with Ye *et al.* [40] who found out that health and nutrition status were very influential factors influencing utilization of nutrition information on food labels [40]. This study found out that taste and brand of the products did not influence food label use. These findings differed with a study by Batra and Batra [42] who reported that brand and taste of the product influenced use of nutrition information on food labels. These may be because of the different populations and the place where the study was conducted.

The findings of this study also indicate that food price was a very influential factor influencing utilization of nutrition information on food label. Drichoutis *et al.* [45] reported that consumers who place importance on food price were less likely to use nutrition information on food labels in general. This agreed with the findings of this study where consumers reported that price was among the factors that highly influenced utilization of nutrition information on food labels [45].



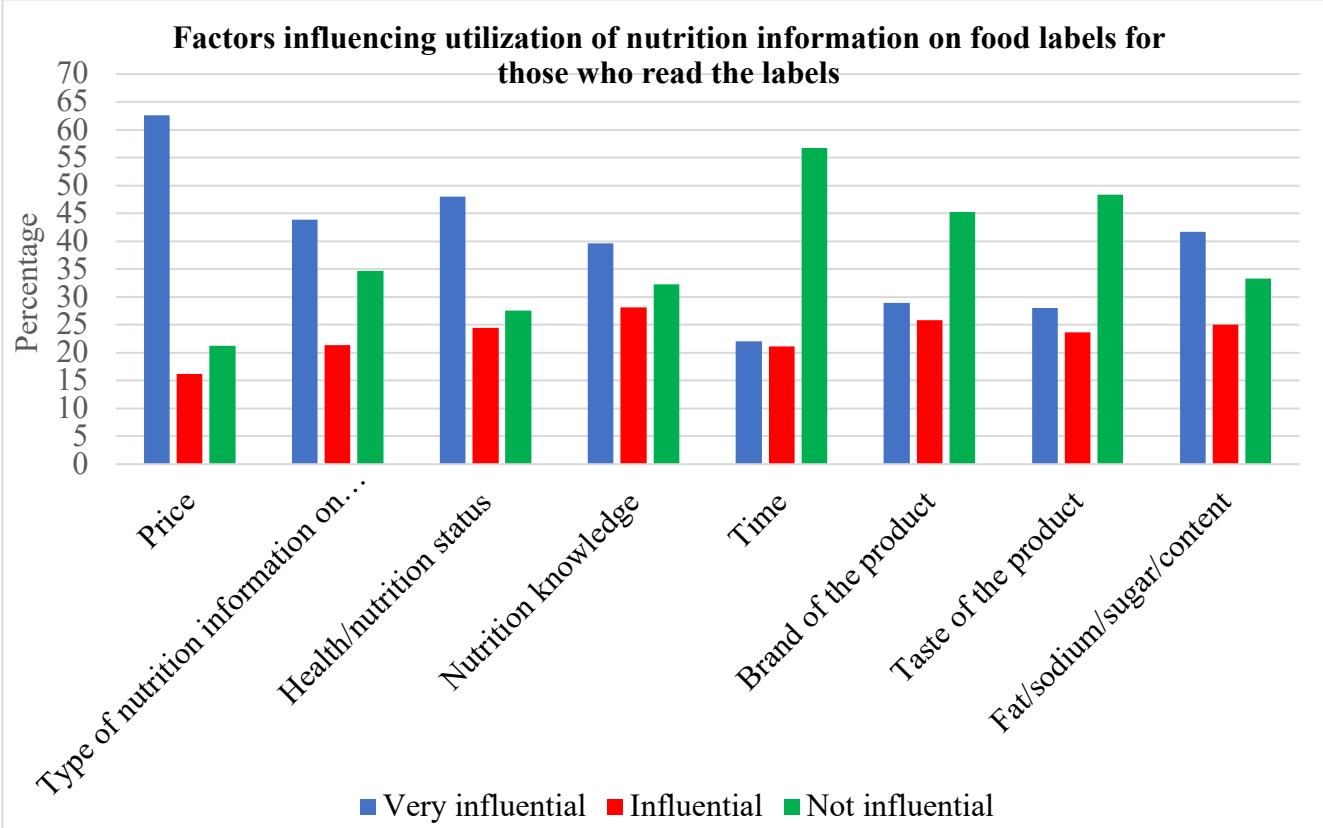


Figure 1:1 Factors influencing utilization of nutrition information on food label

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

In conclusion, this study found out that: age, level of education, job/ employment status, monthly income/level of income and monthly food expenditure influenced utilization of nutrition information on food labels. However, marital status, religion and gender did not influence utilization nutrition information on food labels. The study also concludes that food prices, the type of nutrition information on the food labels, health and nutrition status and fat/sodium/sugar content were the factors that highly influenced utilization of nutrition information on food labels while time, brand of the product and the taste of the product was the least influential factors in utilization of nutrition Information on food labels by patients with *diabetes mellitus* and hypertension attending clinic at Kakamega County Teaching and Referral Hospital (KCTRH).

The study recommends need for health education on the importance of reading nutrition information on food labels in management of chronic diseases so as the help in accurate decision making on dietary choices. This can be done through advertisement on television and radios and nutrition education in different set ups like schools, chiefs' barazas among others. The study also recommends that the



government through the Ministry of Health can adopt a multidisciplinary approach in campaigns on use of food labels. This will help the consumers access to nutrition health information which will assist them make appropriate and healthy food choices.

COMPETING INTERESTS

None of the authors had competing interests

CONFLICT OF INTEREST

None of the authors declared conflict of interest.

CONTRIBUTORS

The authors' responsibilities were as follows: LM, JS, and LM conceived the idea and designed the study. LM trained the research assistants. LM supervised data collection. LM analyzed the data and drafted the manuscript. JS and LM offered supervisory and overall editorial oversight.



Table 1: Socio-demographic characteristics of patients with *diabetes mellitus* and hypertension attending clinic at Kakamega Teaching and Referral Hospital in Kakamega County

	CATEGORIES	FREQUENCY	PERCENTAGE
GENDER	Female	60	60
	Male	40	40
AGE (YEARS)	18-30	2	2
	31-40	7	7
	41-50	14	14
	51-60	31	31
	Above 60	46	46
MARITAL STATUS	Single	4	4
	Married	73	73
	Divorced/separated	5	5
	Widow/widower	18	18
RELIGION	Christian	94	94
	Muslim	4	4
	Any other	2	2
LEVEL OF EDUCATION COMPLETED	Primary	40	40
	Secondary	35	35
	Tertiary	21	21
	Never went to school	4	4
JOB/EMPLOYMENT	Casual laborer	10	10
	Permanent employment	20	20
	Self employed	39	39
	Retired	23	23
	Any other	8	8
MONTHLY INCOME IN KSH.	Below 5000	37	37
	5000-10000	22	22
	10000-20000	16	16
	Above 20000	25	25
HOUSEHOLD MONTHLY FOOD EXPENDITURE (IN KSH.)	Below 5000	38	38
	5000-10000	32	32
	10000-20000	14	14
	ABOVE 20000	16	16

Data are presented as frequency and percentage as indicated. Data on age, education, gender, household monthly food expenditure and occupation of the respondents are presented by categories under each variable. Age and duration of illness are presented in years and monthly income and household food expenditure are presented in Kenyan shillings



Table 2: Effect of sociodemographic characteristics and reading of nutrition information on food labels

Socio-demographic characteristics		Variables		Read nutrition information on food labels
		Yes	No	P value
Gender	Female	37	23	0.634
	Male	27	13	
Age	18-30	0	2	0.028
	31-40	7	0	
	41-50	11	3	
	51-60	19	12	
	above 60	27	23	
Marital status	Single	2	2	0.077
	Married	51	22	
	divorced/separated	3	2	
	widow/widower	8	10	
Religion	Christian	61	33	0.931
	Muslim	1	3	
	any other	1	1	
Level of education completed	Primary	17	23	<0.001
	Secondary	28	7	
	Tertiary	18	3	
	never went to school	1	3	
Job/employment	casual laborer	6	4	0.001
	permanent employment	19	1	
	self employed	22	17	
	Retired	13	10	
	any other	4	4	
Monthly income	below 5000	15	22	0.001
	5000-10000	15	7	
	10000-20000	14	2	
	above 20000	22	3	
Household monthly food expenditure	below 5000	18	20	0.007
	5000-10000	22	10	
	10000-20000	9	5	
	above 20000	15	1	



REFERENCES

1. **GBD 2019 Diseases and Injuries Collaborators.** Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet.* 2020; **396**(10258): 1204-1222. [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9)
2. **Allen L, Williams J, Townsend N, Mikkelsen B, Roberts N, Foster C and K Wickramasinghe** Socioeconomic status and non-communicable disease behavioural risk factors in low-income and lower-middle-income countries: a systematic review. *The Lancet Global Health*, 2017; **5**(3): e277-e289. [https://doi.org/10.1016/s2214-109x\(17\)30058-x](https://doi.org/10.1016/s2214-109x(17)30058-x)
3. **Gouda HN, Charlson F, Sorsdahl K, Ahmadzada S, Ferrari AJ, Erskine H, Leung J, Santamauro D, Lund C, Aminde LN, Mayosi BM, Kengne AP, Harris M, Achoki T, Wiysonge CS, Stein DJ and H Whiteford** Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. *The Lancet Global Health*, 2019; **7**(10): p. e1375-e1387. [https://doi.org/10.1016/s2214-109x\(19\)30374-2](https://doi.org/10.1016/s2214-109x(19)30374-2)
4. **Anderson CAM, Thorndike AN and AH Lichtenstein** Innovation to Create a Healthy and Sustainable Food System: A Science Advisory from the American Heart Association. *Circulation.* 2019; **139**(23): e1025-e1032. Epub 2019 Apr 29. <https://doi.org/10.1161/cir.000000000000686>
5. **Funderburk L, Cardaci T, Fink A, Taylor K, Rohde J and D Harris** Healthy Behaviors through Behavioral Design-Obesity Prevention. *Int J Environ Res Public Health.* 2020; **17**(14): 5049. <https://doi.org/10.3390/ijerph17145049>
6. **World Health Organization (WHO).** Non-Communicable diseases countries profile 2018. <https://www.who.int/publications-detail-redirect/9789241514620> Date Accessed: 13th March 2023.
7. **Bigna JJ and JN Jean** The rising burden of non-communicable diseases in sub-Saharan Africa. *The Lancet Global Health*, 2019; **7**: e1295-e1296: [https://doi.org/10.1016/s2214-109x\(19\)30370-5](https://doi.org/10.1016/s2214-109x(19)30370-5)



8. **Vasiljevic M, Fuller G, Pilling M, Hollands GJ, Pechey R, Jebb SA and TM Marteau** What is the impact of increasing the prominence of calorie labelling? A stepped wedge randomised controlled pilot trial in worksite cafeterias. *Appetite*, 2019. **141**: 104304.
<https://doi.org/10.1016/j.appet.2019.05.035>
9. **Post RE, Mainous AG, Diaz VA, Matheson EM and CJ Everett** Use of the nutrition facts label in chronic disease management: results from the National Health and Nutrition Examination Survey. *J Am Diet Assoc*, 2010. **110(4)**: 628-32. <https://doi.org/10.1016/j.jada.2009.12.015>
10. **Moravia A and T Abel** The WHO report "Preventing chronic diseases: a vital investment" and us. *Soz Praventivmed*, 2006; **51(2)**: 74.
<https://doi.org/10.1007/s00038-005-0015-7>
11. **Al-Jawaldeh A, HammerichA, Doggui R, Engesveen K, Lang K and K McColl** Implementation of WHO Recommended Policies and Interventions on Healthy Diet in the Countries of the Eastern Mediterranean Region. *Nutrients*. 2020; **12(12)**: 3700. <https://doi.org/10.3390/nu12123700>
12. **Kiragu ZW, Rockers PC, Onyango MA, Mungai J and J Mboya** Household access to non-communicable disease medicines during universal health care roll-out in Kenya: A time series analysis. *PLoS One*, 2022; **17(4)**: p. e0266715. <https://doi.org/10.1371/journal.pone.0266715>
13. **Kenya Health Sector Strategic Plan, June 2018-2023 Transforming Health Systems: Achieving Universal Health Coverage by 2022.** Kenya, Ministry of Health (MoH). <https://www.health.go.ke/wp-content/uploads/2020/1> Date accessed: 14th May 2023.
14. **DACS 2014.** Dietary Guidelines for Americans, (2010) (7th edition) Washington DC: U.S. Government Printing Office. Date Accessed: 13th March 2023.
15. **Buyuktuncer Z, Ayaz A, Dedebayraktar D and HT Besler** Promoting a Healthy Diet in Young Adults: The Role of Nutrition Labelling. *Nutrients*, 2018; **10(10)**: 1335. <https://doi.org/10.3390/nu10101335>
16. **Navarrete-Muñoz EM, Torres-Collado L, Valera-GranD, Gonzalez-Palacios SM and M García-de-la-Hera** Nutrition Labelling Use and Higher Adherence to Mediterranean Diet: Results from the DiSA-UMH Study. *Nutrients*. 2018. **10(4)**. <https://doi.org/10.3390/nu10040442>



17. **Sagaceta-Mejía J, Tolentino-Mayo L, Cruz-Casarrubias C, Nieto C and S Barquera** Understanding of front of package nutrition labels: Guideline daily amount and warning labels in Mexicans with non-communicable diseases. *PLOS ONE*. 2022; **17(6)**: e0269892. <https://doi.org/10.1371/journal.pone.0269892>
18. **Perez-Cueto FJA** An Umbrella Review of Systematic Reviews on Food Choice and Nutrition Published between 2017 and 2019. *Nutrients*. 2019; **11(10)**: 2398. <https://doi.org/10.3390/nu11102398>
19. **Oostenbach LH, SlitsE, Robinson E and G Sacks** Systematic review of the impact of nutrition claims related to fat, sugar and energy content on food choices and energy intake. <https://doi.org/10.3390/nu13082684>
20. **Cowburn G and L Stockley** Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutr*. 2005; **8(1)**: 21-28. <https://doi.org/10.1079/phn2005666>
21. **Campos-Nonato I, Cervantes-Armenta M A, Pacheco-Miranda S, Barquera S and J Vargas-Meza** Perception and Understanding of Guideline Daily Amount and Warning Labeling among Mexican Adults during the Law Modification Period. *Nutrients*. 2022; **14(16)**. <https://doi.org/10.3390/nu11102398>
22. **Robinson E, Burton S, Gough T, Jones A and A Haynes** Point of choice kilocalorie labelling in the UK eating out of home sector: a descriptive study of major chains. *BMC Public Health*. 2019; **19(1)**: 649. <https://doi.org/10.3390/nu13041183>
23. **Diaz-Beltran M, Almanza B, Byrd K and C Behnke** Visual Cues and Optimal Defaults in Fast-Food Combo Meals Benefit Health-Concerned Consumers-A Randomized Scenario-Based Experiment *J Acad Nutr Diet*, 2023; **123(1)**: 52-64 e51. <https://doi.org/10.1186/s12937-022-00791>
24. **Champagne B, Arora M, ElSayed A and S Løgstrup** World Heart Federation Policy Brief: Front-Of-Pack Labelling: Unhealthy Changes in the Global Food System. *Glob Heart*, 2020; **15(1)**: 70. <https://doi.org/10.3390/nu14132697>



25. **Corvalán C, Reyes M, Garmendia ML and R Uauy** Structural responses to the obesity and non-communicable diseases epidemic: Update on the Chilean law of food labelling and advertising. *Obesity Review*. 2019; **20(3)**: 367-374. <https://doi.org/10.1111/obr.12802>
26. **Kenya Bureau of Standards.** Front of pack nutrition labelling — Requirements.
https://www.kebs.org/images/standards/public_review_standards/2022/May/DKS_2955_2022 Date accessed: 14th May 2023.
27. **Kenya Ministry of Health.** National Guidelines for Healthy Diets and Physical Activity. 2017. Available from: <https://ncdak.org/wp-content/uploads/2021/08/> Date accessed: 14th May 2023.
28. **Kenya Population and Housing Census.** Kenya bureau of Statistics. Kenya. Nairobi, Kenya. 2019. Available from
<https://housingfinanceafrica.org/app/uploads/VOLUME-II-KPHC-2019.pdf>
Date accessed: 14th May 2023.
29. **Yun YH, Sim JA, Kim Y, Lee S and KN Kim** Consumers' consciousness of health-friendly products and services and its association with sociodemographic characteristics and health status. *Nutrients*. 2020; **12(6)**: 1590. <https://doi.org/10.3390/nu12061590>
30. **Binobead MA, Alotaibi MA, Ranelli N, Chen Y and R Xu** Awareness and usage of nutrition information and effect of sociodemographic characteristics on various aspects of food labels in Al-Ahsa, Saudi Arabia. *Nutr Hosp*. 2022 Oct 17; **39(5)**: 1106-1116. <https://doi.org/10.20960/nh.04087>
31. **Van der Waal NE, Folkvord F, Azrout R and CS Meppelink** Can Product Information Steer towards Sustainable and Healthy Food Choices? A Pilot Study in an Online Supermarket. *Int J Environ Res Public Health*, 2022; **19(3)**. <https://doi.org/10.3390/nu10070891>
32. **Zhang J, Zhai L, Osewe M and A Liu** An analysis of Factors Influencing Food Nutritional Labels Use in Nanjing, China. *Foods*, 2020; **9(12)**. <https://doi.org/10.3390/foods9121796>
33. **Grunert KG, Wills JM and CL Fernandez** Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite*, 2010; **55(2)**: 177-89. <https://doi.org/10.1016/j.appet.2010.05.045>

34. **Aryee P, Helegbe G, Agordoh P, Mohammed J, Muntala J Koblaji F and H Kumoji** Exploring consumer knowledge, understanding and use of food and nutrition label information in the Tamale metropolis of Ghana. *African Journal of Food, Agriculture, Nutrition and Development*, 2019; **19(02)**: 14415-14431. <https://doi.org/10.18697/ajfand.85.17795>
35. **Moore SG, Donnelly JK, Jones S and JE Cade** Effect of Educational Interventions on Understanding and Use of Nutrition Labels: A Systematic Review. *Nutrients*, 2018; **10(10)**. <https://doi.org/10.1136/bmj.k4982>
36. **Egnell M, Talati Z and C Julia** Consumers' Responses to Front-of-Pack Nutrition Labelling: Results from a Sample from The Netherlands. *Nutrients*, 2019; **11(8)**. <https://doi.org/10.3390/nu10101542>
37. **Yamaguchi M, Nomura M, Arai Y, Vandevijvere S, Swinburn B and N Nishi** An assessment of implementation gaps and priority recommendations on food environment policies. *Int J Behav Nutr Phys Act.* 2019; **16(99)**. <https://doi.org/10.1186/s12966-019-0865-7>
38. **Løvhaug AL, Granheim S I and SK Djojosoeprto** The potential of food environment policies to reduce socioeconomic inequalities in diets and to improve healthy diets among lower socioeconomic groups: an umbrella review. *BMC Public Health*. 2022; **22(1)**: 433. <https://doi.org/10.1017/s1368980021000616>
39. **Melo G, Zhen C, Colson G, Reyes M, Kanter R, Vandevijvere S and C Corvalán** Does point-of-sale nutrition information improve the nutritional quality of food choices? *Econ Hum Biol.* 2019; **35**:133-143. <https://doi.org/10.1016/j.ehb.2019.07.001>
40. **Ye L, Zhang J, Yan R, Xiang L, Hu L, Chen H, Weng H and C Meppelink** Association between the awareness of Nutrition Facts Panel and prepackaged food purchase behavior among residents. *Nutrients*. 2017, **9(10)**: 1103. <https://doi.org/10.3390/nu9101103>
41. **Fisher AA, Laing JE, Stoeckel JE and JW Townsend** Handbook for Family Planning Operations Research Design. 1991 (second edition). Population Council, New York.

42. **Darkwa S** Knowledge of nutrition facts on food labels and their impact on food choices on consumers in Koforidua, Ghana: a case study. *South African Journal of Clinical Nutrition*. 2016; **27(1)**, 13-17.
<https://doi.org/10.1080/16070658.2014.11734479>
43. **Shahid M, Waqa G, Pillay A, Kama A, Tukana N and N Nishi** Packaged food supply in Fiji: nutrient levels, compliance with sodium targets and adherence to labelling regulations. *Public Health Nutr*. 2021; **24(13)**: 4358-4368. <https://doi.org/10.1017/S136898002100224X>
44. **Wiles N, Paterson M and J Meaker** What factors determine the use of nutrition information on the food label when female consumers from Pietermaritzburg select and purchase fat spreads? *South African Journal of Clinical Nutrition*. 2009; **22(2)**: 69-73.
<https://doi.org/10.1080/16070658.2009.11734221>
45. **Drichoutis AC, Lazaridis P and RM Nayga Jnr.** Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics*. 2005; **32(1)**: 93–118. <https://doi.org/10.1093/erae/jbi003>

