

Complete Spirit, Soul and Body Health Production in Kenya: Application of Principal Components Analysis and Path Analysis

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ABSTRACT

In Kenya, three disease domains namely communicable diseases, non-communicable conditions and violence/injuries continue to contribute to the high disease burden; and the total disease incidences reported increased by 31.2 percent from 2017 to 2018, with the three leading causes of morbidity being diseases of the respiratory system, Malaria and diseases of the skin (including ulcers). In addition to a sharp decline observed in the three dimensions of financial health namely the ability to manage the day-to-day needs, cope with shocks and invest in livelihood and future. The objective of this study was to establish the production of complete spirit, soul and body health in Kenya through application of the principal components analysis and path analysis techniques. The study established that bad report deteriorates individuals' health; conversely, good report improves their health. Male individuals have worse health compared to their female counterparts and individuals residing in rural areas have worse health compared to their counterparts in urban areas. Consumption of *white ugali* prepared using *refined* / sifted maize flour makes individual's health deteriorate but their health improves with the consumption of *brown ugali*; and/ or *white ugali* prepared using *coarse loose maize* taken with dried/smoked fish and traditional vegetables. In addition, an individual's health improves with the consumption of groundnuts, sweet potatoes and other *roots and tubers* including cooking banana, arrow roots, and yams; and consumption of sugarcane, pears, and soya drink. Individuals' health also improves due to consumption of *fried githeri*; consumption of pasta and taking candies, however, consumption of *tinned proteins* like meat and beans; taking flavoured fresh milk, lard, preserved fruits and other berries; and taking nicotine products makes individuals' health deteriorate. Based on the findings, the study recommends that the government ought to devise more ways of encouraging individuals /households to be deployed by providing financial education and increasing the financial services like the hustler fund project; the government and both local or/and international NGOs should collaborate in giving a helping hand whenever it calls for a response to severe water shortage/ drought or flood; every individual/household ought to have a spiritual authority for seeking spiritual help especially due to chronic illness such as the corona virus to cushion the individuals/households from separation experienced through death shocks; more concerted efforts on health education ought to be put in place and promoted to improve the health of individuals, especially males in the rural areas; individual's need to improve their health by chewing sugarcanes in the morning, taking soya drink or tea prepared using sweet potato leaves with either groundnuts, sweet potatoes, cooking banana, arrow roots, and/or yams for breakfast; and/or in addition to consumption of fruits specifically pears; individuals and households ought to be encouraged to consume *brown ugali* prepared using cassava, sorghum, and millet grain/*wimbi* flour; and/ or *white ugali* prepared using *coarse loose maize* taken with dried/smoked fish with scales and traditional vegetables especially during lunch time; and they need to consume *fried githeri* prepared using a mixture of loose maize grain, beans, salt, onion leeks, and cooking fat for their supper or even pasta/spaghetti.

Keywords: Health Production, Principal Components Analysis, Path Analysis, Shocks, Response to Shocks, Good Reports, Bad Reports, Food and Nutrition.

INTRODUCTION

Background of the Study

Worldwide, chronic diseases are burgeoning, due to the influence of lifestyle factors, and therefore they are responsive to lifestyle modifications, especially dietary modification[31]. Africa is experiencing a nutrition transition with changing dietary habits and food environments related to urbanization, accompanied by rising obesity and diet-related non-communicable diseases [16]. In Kenya, three disease domains namely communicable diseases, non-communicable conditions and violence/injuries continue to contribute to the high disease burden [27], [28], in line with this, expenditures for Diarrheal diseases, Tuberculosis, HIV/AIDS, malaria and respiratory diseases increased by over 30%, with expenditure for non-communicable diseases and injuries increasing by 17.15% and 14.72% from FY2012/13 to FY 2015/16 [30]. However, there are significant decline in non-communicable diseases specifically heart problem and/or blood pressure whenever a response to shocks by individuals/households is done by seeking help from the government or non-governmental institutions [32]. Individuals/households are assumed to use their own time and market goods, not only to consume goods and services from which they derive utility but also to produce them[4], [33].

Prosperity in different aspects of social and economic development calls for individuals who are in complete health[2], and is essential for individuals to enjoy perfect peace which manifests in the whole spirit, soul and body[1] because humanity is a spirit, lives in a body, and possesses a soul. This implies health to the flesh and strength to the bones since The Health Act No. 21 [37] defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Problem Statement

In Kenya, according to the economic survey of 2020, total disease incidences as reported by public health facilities increased by 17.3 percent to 87.8 million in 2019[22], and decreased by 31.6 percent to 60.0 million in 2020 [23] but increased by 57.2 percent to 94.3 million in 2021 [24]. In the period 2017-2021, the three leading causes of morbidity were respiratory system diseases, Malaria and diseases of the skin (including ulcers) which on average accounted for 27.0 percent, 16.0 percent and 5.8 percent of the total disease incidences respectively. Even though over the same period the prevalence of respiratory system diseases, Malaria and diseases of the skin (including ulcers) have decreased by 30.0, 11.6, and 44.3 percent respectively. In addition, financial health which is the ability to use financial services for managing daily needs, and the ability to cope with shocks that an individual may face in helping to invest in future goals; deteriorated to 17.1 percent in 2021 compared with 21.7 percent in 2019. According to the 2021 Fin Access Household Survey, access to financial services and products through informal providers reduced from 6.1 percent in 2019 to 4.7 percent in 2021, while those excluded from accessing any form of financial services rose by 0.6 percentage points, to 11.6 percent in 2021, which could partly be explained by the effects of the COVID-19 pandemic that adversely impacted households' and firms' earnings and employment[5]. Similarly, from the economic survey of 2019, sharp declines were observed in the three dimensions of financial health namely the ability to manage the day-to-day needs, cope with shocks and invest in livelihood and future[21]. Shocks are inevitable to everyone everywhere and in the wake of shock of chronic/severe illness like Corona virus (Covid-19) which is infecting and affecting individuals worldwide and countrywide; the response may be negative or positive. The negative responses act like additional shocks, while the positive responses (good reports) are meant to counter the shocks and improve individuals and consequently household's welfare. Covid-19 led to increased cases of death of household

members with the number of confirmed COVID-19-related deaths nationwide in 2021 being 3,079 up from 1,756 in 2020[24];which calls for immediate response to the shock with stern actions like seeking spiritual help from religious institutions. During the outbreak of the corona virus, many individuals lost their employment and at such a time when loss of salaried employment or non-payment of salary results, individuals ought to positively respond to the shock through various aspects like being deployed or starting a new business. At a time like this ,the health care facilities are overstrained with many hospitalizations, resulting from day to day increase in the shocks (corona virus) and its associated shocks like loss of employment, business failure and death. Whenever individuals lose their body through death then they must leave, for they become illegal on earth since it’s their body which keeps them legal on earth to have dominion [14]. Likewise, the governments’ curfews have made individuals limit their movements, reduce physical activity, and change their food and nutrition and as a result may have negatively affected their health outcomes.

Objective of the Study

To establish the production of complete spirit, soul and body health in Kenya through application of the principal components analysis and path analysis techniques

METHODOLOGY

Data

The secondary data used in this study was from the Kenya Integrated Household Budget Survey (KIHBS), 2005/2006’’. The sampling techniques were elaborated in a study by [32] and the details of the survey data are provided in a study by [34].

Principal Components Analysis (PCA)

This study used Principal Component Analysis (PCA) to create index components through reduction from a set of three variables. This made it possible to identify the factors that accounted for most of the variance in the production of health. The study computed the component loadings, which were the correlation coefficients between the factors and components. The PCA determined the underlying structures for measures on the following three variables: health conditions and sought medical services, shocks and response to the shocks, and food and nutrition.

PCA for Health Conditions and Sought Medical Services:

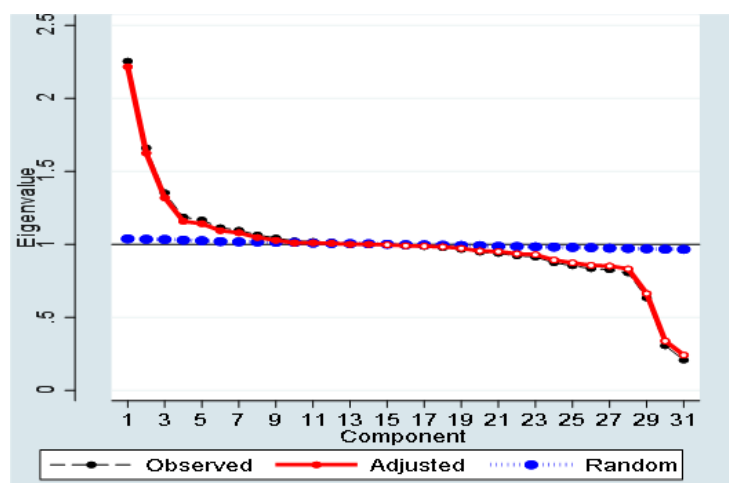


Figure 1: Horn’s parallel analysis for Health Conditions and Medical Services

After extracting all the principal components, Horn’s parallel analysis was used to determine the number of components to retain for rotation and interpretation as illustrated in figure 1. The components were rotated using a Varimax (Kaiser) rotation. This criterion produced nine components and was included because they represent important aspects of the various health conditions and sought medical services and could conveniently be interpreted. The highest loadings on each component were highlighted and the interpretation of components was based on them. For the health conditions and seeking medical services, the nine components conveyed 38.53% of the total variation of the set of 31 original factors.

Table I: Principal Component Analysis for Health Conditions and Sought Medical Services

Factors	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8	Comp9	Explained
Chronic Malaria/Fever	0.0086	0.5823	-0.0248	0.019	-0.0267	-0.0291	-0.0023	0.0137	-0.1252	0.5671
Diarrhoea	-0.0157	0.0432	-0.001	-0.0218	0.0153	0.0016	0.6815	-0.0075	-0.0677	0.5617
Stomach Ache	0.0118	0.0303	-0.0146	-0.062	-0.0198	0.6003	0.1256	-0.0495	0.1879	0.5291
Vomiting	-0.001	-0.014	-0.0032	0.0092	-0.0336	-0.0022	0.6768	0.0056	-0.0059	0.5407
Upper Respiratory(Sinuses)	0.0085	-0.0005	-0.0011	-0.0194	-0.0404	-0.0055	0.0229	0.3966	-0.0178	0.178
Lower Respiratory (Chest, Lungs)	0.0174	0.1007	0.0167	-0.0549	-0.0151	-0.081	-0.0288	0.4814	0.1093	0.3187
Flu	0.0268	0.3315	-0.0371	-0.0954	0.0163	-0.214	-0.0562	-0.154	0.1983	0.2889
Asthma	-0.0046	0.0012	0.7063	-0.0268	-0.0132	-0.0128	-0.0057	-0.0272	-0.0003	0.6827
Headache	-0.0125	0.1277	-0.0146	-0.041	-0.0269	0.1496	-0.0349	0.0272	0.5049	0.3684
Dental Problem	-0.0561	0.1029	-0.0171	0.0811	0.0312	-0.0912	-0.0683	-0.1086	0.2917	0.1444
Backache	0.0566	-0.022	0.0241	-0.0037	0.0092	0.0807	-0.043	0.087	0.4104	0.217
Heart Problem	0.0094	0.007	-0.0086	-0.0517	0.3125	-0.0442	-0.0028	-0.049	0.0787	0.1299
Blood Pressure	0.0347	-0.0135	-0.0021	-0.0694	0.6067	-0.0702	0.014	0.0189	0.0677	0.4625
Diabetes	0.015	-0.0259	-0.0141	-0.0402	0.5738	-0.0293	-0.0094	-0.0214	-0.0171	0.3996
Mental Disorder	-0.1124	0.0126	-0.0004	0.5339	-0.0556	-0.1052	0.0053	-0.1213	0.0863	0.3707
Sexually Transmitted Disease	-0.0169	-0.0037	-0.0032	-0.0151	0.1659	0.1123	-0.0375	-0.0357	-0.0366	0.0521
Fracture	-0.025	0.0631	-0.0064	0.2673	-0.0189	-0.0042	-0.0121	-0.0311	-0.0966	0.102
Unspecified Long-Term Illness	0.0513	-0.0337	0.0044	0.2651	-0.0314	0.0685	-0.0217	0.0451	-0.0013	0.1099
HIVAIDS	0.1137	0.0356	0.0357	-0.0801	-0.0304	0.0409	-0.0491	-0.0251	-0.0013	0.0359
Typhoid	0.0169	0.2921	-0.0134	0.0086	-0.0719	0.115	-0.1268	-0.0338	-0.4716	0.3811
Cancer	0.009	0.0106	-0.0171	0.104	-0.0015	0.0959	-0.0737	0.0425	-0.0861	0.0409
Arthritis/Rheumatism	0.0256	-0.0072	0.6987	0.0099	-0.0016	-0.0063	0.0038	0.0147	0.0088	0.6754
Nerve Disorder	-0.0704	-0.0658	-0.001	0.4006	-0.0478	-0.0568	0.0408	0.0557	0.2519	0.2707
Stomach Disorder	0.0226	-0.0482	-0.0043	0.0138	-0.0039	0.6565	-0.0832	-0.064	-0.02	0.513
Pneumonia	-0.0353	-0.0767	-0.0347	0.0374	-0.0184	0.0043	-0.0141	0.6956	-0.0244	0.5365

No of the times consulted a health provider	0.0073	0.6300	0.0448	0.0257	0.0312	0.0713	0.0769	0.0945	0.1324	0.8152
Sweep the floor with difficulty or not at all able	0.6753	-0.0095	-0.0108	0.049	0.0072	-0.0142	0.016	0.02	-0.0029	0.8574
Walk for 2km flat path with difficulty or not at all able	0.6757	-0.0033	-0.0086	0.0498	0.0147	-0.0097	0.018	0.0152	-0.0055	0.8619
Sought preventive services from a health provider	-0.0978	0.0396	0.022	0.2051	0.3074	0.0897	0.0709	0.0316	-0.0882	0.212
Hospitalized in the past 12 months ago	-0.0649	0.0775	0.0567	0.3191	0.249	0.199	-0.0512	0.1731	-0.1868	0.3652
Physically handicapped	0.1645	-0.0211	-0.0152	0.4569	-0.0074	-0.0391	0.0176	-0.0781	0.0244	0.3568
Variance (total 11.95)										11.95
% of total variance explained ALL 31 factors = 38.53%										38.53

Table I shows the results of the principal components analysis (PCA) for the health conditions and sought medical services. The overall KMO measure of sampling adequacy of 0.5148 fell within the recommended bare minimum value of 0.5. This was an indication that there was a linear relationship between the 31 factors and that it was appropriate to run a principal component analysis. To establish the umbrella term used to summarize a set of factors that loaded highly on a specific component, the highest loadings greater than 0.3 were selected and highlighted. The first component (comp1) loads on the swept floor or walks for a 2km flat path with difficulty or not at all able to represent physical disability in individuals. The second component (comp2) represents health conditions which make individuals frequently consult health providers, and they include chronic malaria/fever and flu (MFF). The third component (comp3) is associated with asthma and arthritis/rheumatism (AAR). The fourth component (comp4) represents health conditions which cause both physical disability and hospitalization among individuals in the previous 12 months. Based on the computed principal components they are mental disorder and nerve disorder (MND). The fifth component (comp5) is interpreted to represent health conditions which make individuals seek preventive services from health providers; they are heart problems, blood pressure, and diabetes (HBPD), all of which are non-communicable diseases (NCDs). The sixth component (comp6) represents stomach ache, and stomach disorder (SASD). The seventh component (comp7) was interpreted as diarrhoea and vomiting (DV). The eighth component (comp8) loads highly on pneumonia, upper respiratory (Sinuses), and lower respiratory (chest, lungs) (PULR); while the ninth component (comp9) loads on backache and headache (BHX) which are signs and symptoms of an underlying health condition particularly typhoid and dental problem.

Factor SASD representing stomach ache, and stomach disorder had a regression value of 0.872 and factor BHX loading on signs and symptoms like backache and headache had a regression of 0.993.

Hence, since for these two factors (SASD and BHX) the regressions were greater than 0.70, they (SASD and BHX) were excluded in the final analysis as the dependent variables. Both of the factors are body aches such as stomachache, backache and headache and they represent signs and symptoms of an underlying health condition such as typhoid and dental problem.

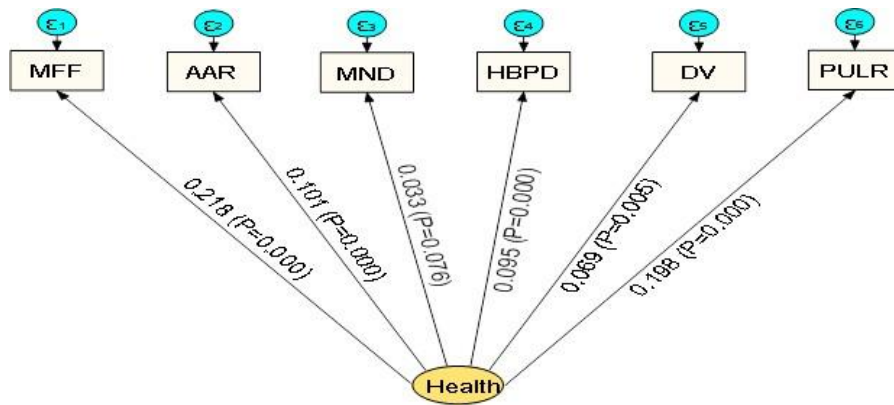


Figure 2: Path Analysis Diagram for Health

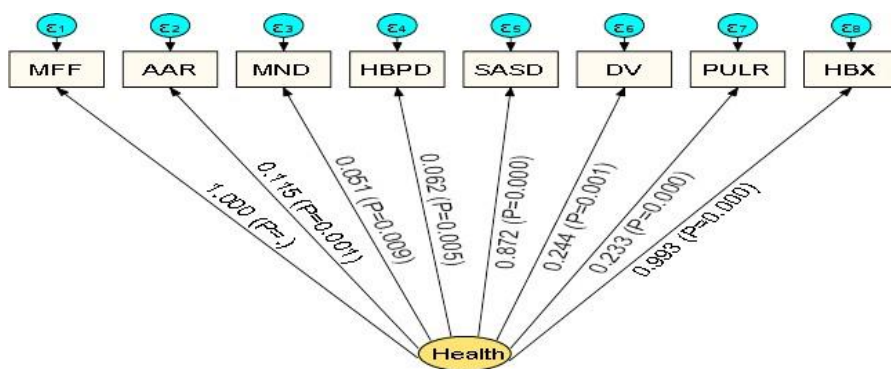


Figure3:Path Analysis Diagram for Refined Health Indicators

Certain factors especially MFF, MND and HBPD are very crucial as they are directly linked with the demand for medical services such as frequenting health providers for consultation, hospitalization, physical disability and preventive care[34]. Individuals frequent health providers due to health conditions such as chronic fever/ malaria and flu. Moreover, some health conditions like mental disorder and nerve disorder causes physical disability and hospitalization among individuals. Eventually, individuals demand preventive care mainly due to non-communicable diseases represented such as heart problems, blood pressure, and diabetes.

PCA for Shocks and Response to the Shocks:

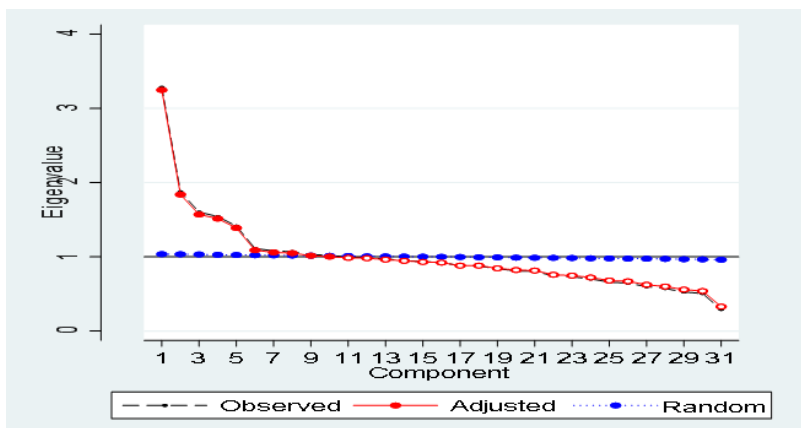


Figure 4: Horn’s parallel analysis for Shocks and Response to the Shocks

After extracting all the principal components, Horn’s parallel analysis was used to determine the number of components to retain for rotation and interpretation as illustrated in figure 4. The components were rotated using a Varimax (Kaiser) rotation. This criterion produced eight components and was included because they represent important aspects of the various shocks and ways of responding to the shocks and could conveniently be interpreted. The highest loadings on each component were highlighted and the interpretation of the component is based on them. For the various shocks and the ways of responding to the shocks, the eight components conveyed 41.89% of the total variation of the set of 31 original factors.

Table II: Principal Component Analysis for Shocks and Response to the Shocks

Factors	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8	Explained
Severe water shortage Drought or Floods	0.065	0.4754	0.03	-0.0713	0.0126	0.0717	-0.0266	0.0153	0.516
Death of HH head, working member of the household, or another family member	0.001	-0.1146	0.0945	0.6032	0.0466	-0.0409	-0.0017	-0.0297	0.6386
Asset /Dwelling damaged, destroyed by Fire, Carjacking/Robbery/burglary/assault	-0.0959	0.013	0.1235	0.1005	-0.0597	0.2079	0.0037	-0.0098	0.1331
Crop disease or crop pests	-0.0187	0.0878	-0.0999	-0.0285	0.2019	0.2167	-0.1177	0.0206	0.1661
Livestock died or was stolen	-0.0442	0.3711	0.0788	0.002	0.062	-0.0104	0.0117	0.0359	0.2963
Household business failure, non-agricultural	0.0185	-0.0735	-0.0137	0.0018	-0.0773	0.6001	-0.0017	-0.051	0.5072
Loss of salaried employment or non-payment of salary	0.0295	-0.0549	0.0374	-0.0246	-0.0384	0.0715	0.6698	-0.0563	0.6138
End of regular assistance, aid, or remittances from outside HH	0.1045	-0.0332	0.0414	-0.0421	-0.0691	-0.0517	0.0119	0.3747	0.2045
Large fall in sale prices for crops	0.0062	-0.013	-0.0764	-0.0331	0.5672	0.0162	-0.0098	-0.0554	0.5023
Large rise in the price of food	0.4459	0.0128	-0.0074	0.0162	0.1474	0.0243	0.0293	-0.0667	0.5399
Large rise in agricultural input prices	0.0585	-0.0697	-0.0305	-0.0503	0.5537	-0.0418	0.0135	-0.0585	0.4976
Chronic/severe illness or accident of household member	-0.0823	-0.0058	0.5389	0.0912	-0.0167	-0.0807	-0.0032	-0.0196	0.504
Birth in the household	0.1632	-0.0807	0.3598	-0.2791	-0.1758	0.0815	-0.1568	-0.0589	0.3444
Break-up of the household	-0.0674	-0.0452	-0.1313	0.0744	0.0336	0.1114	0.0125	0.5627	0.4022
Jailed	-0.0412	-0.0576	0.2024	-0.0523	-0.0461	0.0472	-0.1381	0.2585	0.167
HIV/AIDS	0.0055	-0.0233	-0.1172	0.2316	0.0228	0.1119	-0.0925	-0.0463	0.1104
Spent cash saving	0.0197	0.0068	0.2684	0.1119	0.2931	0.0819	0.0761	-0.1241	0.3959
Removed children from school to work/ Sent children to live with relatives	0.018	0.0564	-0.028	-0.0046	0.031	-0.0387	0.0507	0.5983	0.4362
Sold farmland, animals, more crops, assets like (tools, furniture etc),	-0.0558	0.2699	0.3265	-0.0132	0.2058	-0.0036	-0.0282	0.0982	0.4617
Rented out farmland	-0.0537	-0.0074	0.0571	0.04	0.2589	-0.073	-0.0119	0.1649	0.1506

Other household members who weren't working went to work/ Worked more, worked longer hours	0.0799	0.0862	0.1042	-0.0562	0.1544	0.3463	-0.0816	0.1335	0.3595
Started a new business	-0.0324	-0.0028	-0.0598	0.0307	-0.0414	0.5934	0.1042	-0.0247	0.5214
Went elsewhere to find work for more than a month	-0.0091	0.0546	0.0071	-0.0463	0.0269	-0.0478	0.6683	0.0752	0.5745
Borrowed money from relatives, money lenders, institutions (banks etc)	0.0294	-0.0283	0.4198	-0.0445	-0.0137	0.0398	0.0641	-0.0019	0.3002
Received help from local or/and international NGO	0.0108	0.4690	-0.1327	0.0569	-0.0825	-0.0389	0.0186	-0.0651	0.461
Received help from the Government	-0.0018	0.5161	-0.044	0.0171	-0.0882	-0.0015	0.0051	-0.0733	0.5257
Spiritual help from religious institutions including prayers, sacrifices, or consulted diviner	0.067	0.0553	-0.0939	0.5488	-0.036	0.0142	-0.034	0.007	0.5098
Received help from family/friends	0.031	0.0681	0.2325	0.3695	-0.092	-0.0015	0.0488	0.0568	0.4525
Reduced food consumption	0.4726	0.0662	-0.0263	0.0042	-0.0486	-0.0254	-0.0226	0.0356	0.5619
Consumed lower cost, but less preferred foods	0.4951	-0.0247	-0.0061	0.044	-0.0527	-0.0107	-0.0139	0.0434	0.5774
Reduced non-food expenditures	0.4909	-0.0413	0.0151	0.0039	-0.0065	-0.0138	0.0289	0.0187	0.5543
Variance (total 12.99)									12.99
% of total variance explained ALL 31 factors = 41.89%									41.89

Table II shows the results of the principal component analysis for the shocks and ways of responding to the shocks. The overall KMO measure of sampling adequacy of 0.6343 fell within the recommended minimum value of 0.5. This was an indication that there was a linear relationship between the 31 factors and that it was appropriate to run a principal component analysis. To establish the umbrella term used to summarize a set of factors that loads highly on a specific component, the highest loadings greater than 0.30 were selected and highlighted. The first component (comp1) represents a shock in a large rise in the price of food and the response to shocks was through consuming lower cost but less preferred foods, reducing food consumption, and reducing non-food expenditures. The second component (comp2) represents the shock of severe water shortage/ drought or floods which leads to a reduction in livestock as some die and/or are stolen. The response to shock was done through receiving help from the government, and local or/and international NGOs. The third component (comp3) represents shock of chronic/severe illness or accident of household member and birth in the household; and the response to shock was through selling farmland, animals, more crops, and other assets like tools and/or furniture and borrowing money from relatives, money lenders or institutions like banks. The fourth component (comp4) represents death shock (either for the household head, working member of the household, or another family member); the response to shock is mainly through seeking spiritual help from religious institutions including prayers, sacrifices, or consulting a diviner; and receiving help from family/friends. The fifth component (comp5) represents two types of interrelated shocks namely a large rise in agricultural input prices and a large fall in sale prices for crops. The sixth component (comp6) represents non-agricultural household business failure, and the response to shocks was done through starting a new business; ensuring other household members who weren't working went to work/ worked more, or even worked longer hours. The seventh component (comp7) represents shock due to loss of salaried employment or non-payment of salary, and the response is by going elsewhere to find work for more than a month. The eighth component (comp8) represents the shock of the break-up of the household and the end of regular assistance, aid, or remittances from the outside household; and the

response to shocks was removing children from school to work/ sending children to live with relatives.

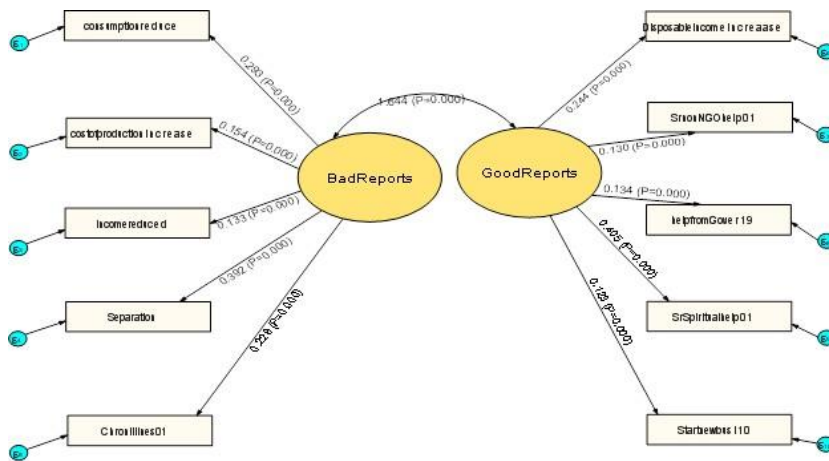


Figure 5 :Path Analysis for Shocks

Based on the shocks and response to the shocks, two main groupings can be deduced as presented in figure 5; the first group consists of bad reports and the second group comprises good reports to the individuals. Bad reports which are deemed to worsen individuals/ households' welfare consist of all the shocks and the negative response to the shocks; while good reports which improve individuals/ households' welfare consist of the positive response to the shocks. The specific shocks for bad reports are chronic illness; separation (death, finding work for more than a month, break-up, and sending children to live with relatives); income reduced (household business failure and loss of employment); cost of the production increase (large fall in crop prices, large rise in agricultural inputs, water shortage and drought); and consumption reduced (reduced food consumption, non-food expenditure, consuming lower cost foods). Good reports include response to severe water shortage/ drought or flood shocks through receiving help from the government and receiving help from local or/and international NGOs; response to chronic/severe illness shock through an increase in disposable income (borrowing money); response to death shock by seeking spiritual help; and response to non-agricultural household business failure shock through starting a new business.

PCA for Food and Nutrition:

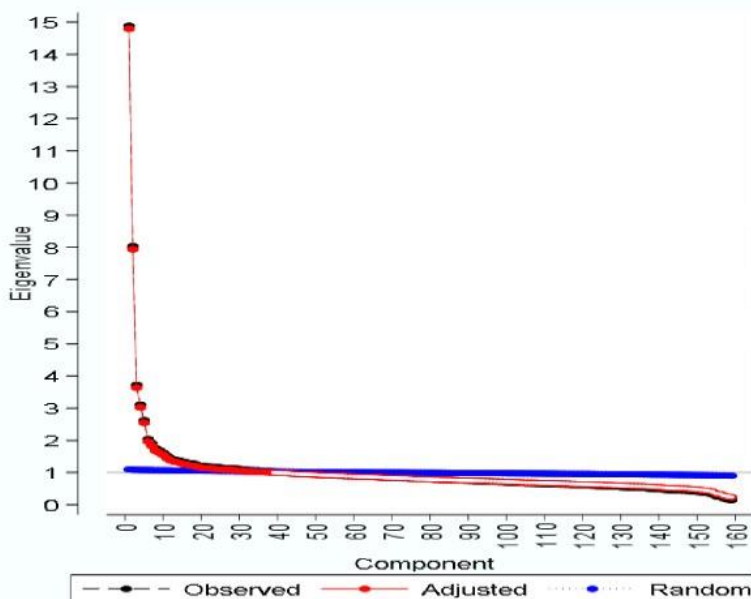


Figure 6: Horn's parallel analysis for Food and Nutrition

After extracting all the principal components, Horn’s parallel analysis was used to determine the number of components to retain for rotation and interpretation as illustrated in figure 6. The components were rotated using a Varimax (Kaiser) rotation. This criterion produced 31 components and was included because they represent important aspects of the various food and nutrition and could conveniently be interpreted. The highest loadings on each component were highlighted and the interpretation of components is based on them. For food and nutrition, the 31 components conveyed 42.51% of the total variation of the set of 159 original factors.

The table showing the results of the 159 original factors and their corresponding 31 principal components for food and nutrition was bulky to fit in the text and hence was left in a separate excel file, which can be availed upon request. The overall KMO measure of sampling adequacy of 0.9378 fell within the recommended minimum value of 0.5. This was an indication that there was a linear relationship between the 159 factors and that it was appropriate to run a principal component analysis. To establish the umbrella term used to summarize a set of factors that loads highly on a specific component, the highest loadings greater than 0.25 (0.3 to the nearest one decimal place) were selected and highlighted.

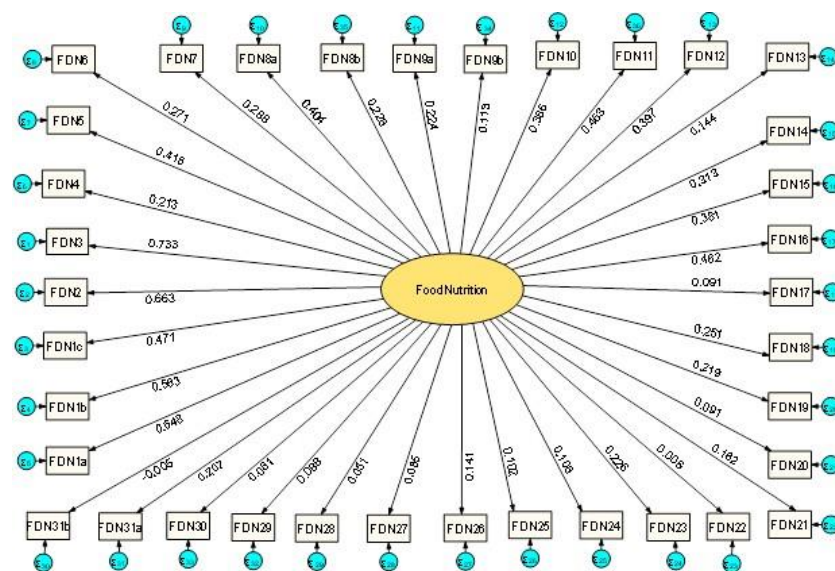


Figure7: Various Components of Food and Nutrition

The first component represents (FDN1a) ingredients for preparing tea (tea leaves, sugar only, milk), (FDN1b) *friedgitheri* (maize grain lose, beans, salt, onion leeks, cooking fat), and (FDN1c) *ugali* (maize flour). The second component (FDN2) represents bread and soda. The third component (FDN3) is associated with pilipilihoho, Dania, spinach, rice, and melons. The fourth component (FDN4) represents grapes, mustard, cauliflower, cheese, and lettuce. The fifth component (FDN5) is interpreted to represent chilli sauce, tomato sauce, peanut butter, and jam. The sixth component (FDN6) represents dried/smoked fish, maize flour loose, other vegetables, groundnuts, and sweet potato. The seventh component (FDN7) is ham salami, minced meat, beef without bones, and bacon. The eighth component is labelled as (FDN8a) cooking banana, arrowroots, yams, squashes and (FDN8b) pumpkins. The ninth component was interpreted as (FDN9a) vegetables (courgette, and celery), vinegar, and (FDN9b) wine; while the tenth component (FDN10) was interpreted as camel meat, cooking oil, pasta (spaghetti/macaroni). Component 11 (FDN11) represents food from vendors, milk fresh packets, fresh fish, and coconut. Component 12 (FDN12) represents sweets, chewing gum, and biscuits. Component 13 (FDN13) is associated with sorghum grain, cassava flour, sorghum flour, millet grain *wimbi*, and cassava. Component 14 (FDN14) represents vegetables (okra, biringanya, and cucumber). Component 15 (FDN15) is interpreted to represent other pulses, drinking chocó, chocolate, and tea bags. Component 16 (FDN16) represents cowpea, peas, grams, and other millet grain flour.

Component 17 (FDN17) represents tinned vegetables and pulses as it is composed of vegetables tinned and pulses tinned. Component 18(FDN18) is labelled as an alcoholic beverage (cider),and ingredients for making dough (baking powder, and yeast). Component 19(FDN19)was interpreted as drugs and substance abuse (spirits, beer, and cigarettes); while component 20(FDN20)was interpreted as fruits (peaches),corned beef, and pickles. Component 21(FDN21) represents milk fresh flavoured, lard, other berries ,and preserved fruit. Component22 (FDN22)represents traditional drugs and substances composed of snuff and traditional brew. Component23 (FDN23)is associated with fresh cream, marmalade, and mala. Component24 (FDN24)represents miraa, tobacco processed, and grounded coffee. Component25 (FDN25) is interpreted to represent tinned meat and beans (meat tinned, and beans tinned). Component26(FDN26) represents plums and frozen fish fillets. Component27 (FDN27)is UHT fresh flavoured and other sugars. Component28(FDN28) is labelled as barley and other cereals, and milk powder. Component29 (FDN29)was interpreted as baby milk, cereals tinned, and ghee from milk; component 30 (FDN30)was interpreted as sugar icing, and fish tinned; while component 31 represents (FDN31a)other meats, sugarcane, pears, soya drink ,and(FDN31b)cigars. Component FDN3 representing pilipilihoho, Dania, spinach, rice, and melons had a regression value of 0.733, and since the regressions were greater than 0.70,FDN3 was excluded in the final analysis as a measure for food, diet and nutrition.

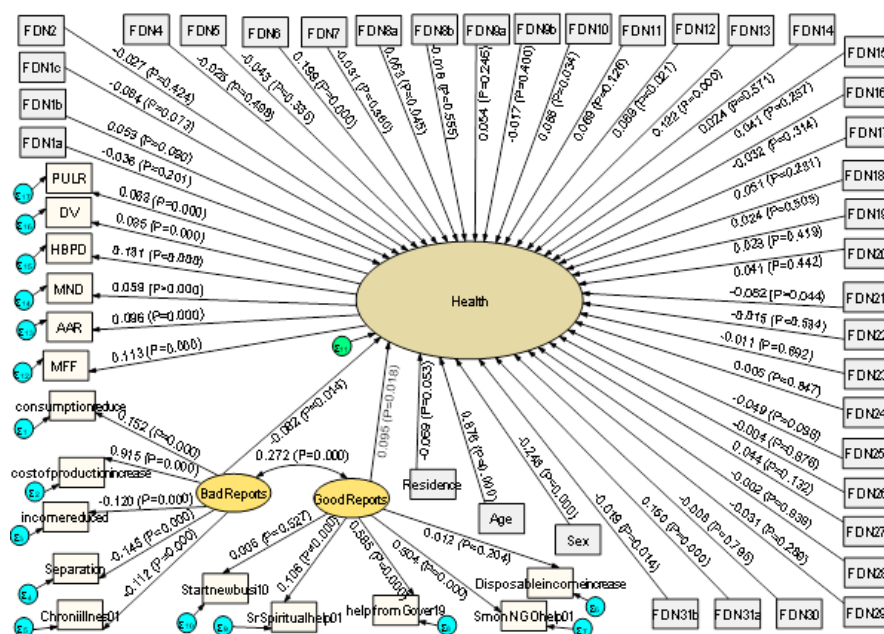


Figure 8: Path Analysis Diagram for the Full Structural Equation Model

RESULTS AND DISCUSSION

The path diagram results in figure8gave a negative coefficient for bad reports of -0.082 with an associated p-value of 0.014 which is statistically significant .Bad reports which had the expected negative sign and were statistically significant are a chronic illness of household member; separation (death, finding work for more than a month, break-up, and sending children to live with relatives); and reduction in disposable income (household business failure and loss of employment). This indicates that bad reports particularly chronic illness, separation, and reduction in disposable income harm individuals’ health by making their health deteriorate. The deterioration in health could be triggered by depletion in bone health since according to [34]bad reports lead to deterioration in bone health. These findings are in line with what was manifested in the life of a man who was living in full health until he got disturbing news about the loss of family members (his children) and loss of income when his livestock died out of a natural calamity[19]. The body responded by fever (trembling) and all his bones were shaking as a result of bad report.

Figure8 gave a coefficient for good reports of 0.095 with an associated p-value of 0.018 which is less than

the critical p-value of 0.05 (5percent) indicating that the variable is statistically different from zero, and hence statistically significant. Good reports which were statistically significant include response to the shock of severe water shortage/ drought or floods through receiving help from government/local NGO or/and international NGO; and response to death shock through seeking spiritual help. The fact that the coefficient is positive and statistically significant indicates that the presence of good reports and in particular help from the government, NGOs, and spiritual authorities leads to an improvement in individuals' health. The current study findings concur with the words of the wisest, richest, and most influential king in Israel's history ;that pleasant or kind words are like honey, sweet to the soul and healthy for the body[36].

A positive coefficient of 0.876 (p-value 0.000) which is statistically significant at the 5 percent level for age($P < 0.05$), shows that individuals' health improves with the increase in age of an individual. A coefficient for sex of -0.246 (p-value 0.000) which is less than 5 percent produced, implies that male individuals have statistically significant worse health compared to their female counterparts. Likewise a negative coefficient of -0.069 (p-value 0.053) which is statistically significant ($P < 0.1$) at the 10 percent level for residence, shows that individuals who reside in rural areas have worse health compared to their counterparts residing in urban areas. Hence more concerted efforts on health education ought to be put in place and promoted to improve the health of male individuals, especially in rural areas.

A positive coefficient of 0.122 (p-value 0.000) which was statistically significant ($P < 0.05$) at the 5percent level was deduced for *brown ugali* (sorghum grain, cassava, and millet grain/*wimbi* flour). The findings illustrate that consumption of *brown ugali* helps in improving individuals' health. A negative coefficient of -0.064 (p-value 0.073) which was statistically significant ($P < 0.1$) at the 10 percent level was deduced for *refined white ugali* (sifted maize flour). This shows that eating white ugali especially prepared using refined maize flour harms individuals' health as it leads to a deterioration of individuals/households' health. A positive coefficient of 0.199 (p-value 0.000) was deduced for *white coarse ugali with fish and traditional vegetables) plus groundnuts and sweet potato* (mixture of dried/smoked fish, loose maize flour, other vegetables, groundnut, and sweet potato). Since ($P < 0.05$), the coefficient was statistically significant at the 5 percent level it shows that individuals' health improves with individuals' consumption of *white ugali* prepared using *coarse loose maize* taken with fish and traditional vegetables in addition to groundnuts and sweet potatoes. A positive coefficient of 0.063 (p-value 0.045) was deduced for *roots and tubers* (cooking bananas, arrow roots, yams, and squashes). Since ($P < 0.05$), the coefficient was statistically significant at the 5 percent level indicating that consumption of roots and tubers improves individuals' health.

The findings revealed that an individual's health improves due to consumption of *brown ugali*; and/ or *white ugali* prepared using *coarse loose maize* taken with dried/smoked fish and traditional vegetables but deteriorates with consumption of *white ugali* prepared using *refined/ sifted* maize flour. On the same note [11] observed that the preparation of refined maize flour results in excessive loss of nutrients, and is perceived as "rich people" food, while unrefined flour such as whole kernel maize flour is classified as "food for the poor". Unblended whole milled maize, finger millet and sorghum are recommended for preparing *ugali* and *Uji* for people suffering from non-communicable diseases [40]. The dried/smoked fish ought to be in particular those which has fins and scales like tilapia fish, but not fish without fins and scales[7], [26] such as cat fish as they absorb high levels of poison including mercury and iodine which have high negative repercussions' on an individual's health.

A positive coefficient of 0.053 (p-value 0.090) was deduced for *fried githeri* (mixture of loose maize grain, beans, salt, onion leeks, and cooking fat). Since ($P < 0.1$) the coefficient was statistically significant at the 10 percent level showing that consumption of *fried githeri* improves individuals' and households' health. Aside from *ugali* being the staple food, individuals' and households' health improves with the consumption of *fried githeri*. In Kenya, 17% and 23% of consumers prefer *githeri* (maize cooked with beans) as the first choice for lunch and dinner, respectively[11]. *Githeri* as a diet is composed of Cereals and pulses which

contain carbohydrates (starch), fibre, iron and zinc [29],[38]. Zinc particularly helps in growth and development, maintenance and healing of tissues; and functioning of the immune system[29].

In addition, the findings showed that an individual's health improves with the consumption of groundnuts, sweet potatoes and other *roots and tubers* including cooking banana, arrow roots, and yams. White *roots and tubers* mainly supply carbohydrates (starch), fibre, and potassium to the body [29]. The sentiments on improvement in health resulting from consumption of groundnuts were echoed by [39] that groundnuts/peanuts play a vital nutritional role as they contain healthy fats and are high in protein than well-balanced meat – about two and a half times more than eggs, and for more than any other vegetable food except soybean. Improvement in health due to sweet potato consumption was in deed expounded by [17] who elaborated the health-promoting functions that sweet potato roots and tops possess relevant to human health. Moreover, [18] noted that sweet potato is one of the most important crops in the world because of not only its considerable amount of nutrients but also phytochemicals in its root and leaves irrespective of its colour; whether purple, red, yellow or white. About 80 to 90 percent of sweet potato dry matter is made up of carbohydrates, consisting mainly of starch and sugars. Sweet potato also contains protein, dietary lipid and ash. It contains essential mineral nutrients such as calcium, phosphorus, magnesium, sodium, potassium, sulphur, iron, zinc, aluminium and B; in addition is also an important source of vitamin A, vitamin B1 (thiamin), vitamin B2 (riboflavin), vitamin B3 (niacin), and vitamin C (ascorbic acid). Sweet potato leaves are comparable to spinach in nutrient content as they contain as many vitamins, minerals and other nutrients as spinach, with the levels of iron, calcium and carotene ranking among the top, in comparison to other major vegetables. Sweet potato leaves are also rich in vitamin B, β -carotene, iron, calcium, zinc and protein. Sweet potato leaves have antidiabetic compounds that reduce blood glucose content significantly and its leaves are a physiologically functional food that offers protection from diseases linked to oxidation such as cancer, allergies, ageing, HIV and cardiovascular problems. The sweet potato leaves are used as a vegetable, tea, noodles, and bread, in confectioneries and when used as a nutritional supplement they can be a beneficial food source[17].

The results on the improvement of health arising from the consumption of cooking bananas support those by [8] who observed that cooking bananas is one of the most important staple food and cash crops in East Africa and plays a central role in food security all year round; they are rich in carbohydrates, alkali-forming minerals, vitamins, dietary fibres, they contain 75% water, and also contain lots of potassium, little protein and low-fat. The findings on improvement in health due to yam consumption are in line with deductions by [13] that water yamis an important tuber crop containing the nutritional value of proximate including moisture, carbohydrate, fibre; protein, fat, and ash, and mineral contents like potassium, calcium, magnesium, iron, zinc and phosphorous.

Sugarcane, pears, soya drink, and other meat had a positive coefficient of 0.150 (p-value 0.021). Since ($P < 0.05$) the coefficient was statistically significant at the 5 percent level, which indicates that an individual's health improves with the consumption of sugarcane, pears, soya drink, and other meats. In line with these findings [3] documented that sugarcane contains fructose and glucose and remains the cheapest energy-giving crop, as it is highly nutritious, containing natural sugars, several minerals such as calcium and iron, vitamins, amino acids, organic acids, starch, phosphatides, and gums. In addition to its cooling effects, sugar cane juice aids in the recovery from haemorrhage, dysuria, anuria, jaundice, cancer, and cardiovascular, and urinary diseases. However, a negative coefficient of -0.062 (p-value 0.044) was deduced for lard, flavoured fresh milk, preserved fruit, and other berries. Since ($P < 0.05$) the coefficient was statistically significant at the 5 percent level, showing that taking flavoured fresh milk, lard, preserved fruits and other berries makes individuals' health deteriorate. This supports the assertion by [29] that individuals ought to limit the consumption of sweetened foods and drinks.

A positive coefficient of 0.088 (p-value 0.034) was deduced for camel meat, cooking oil, and pasta/spaghetti, similarly, a positive coefficient of 0.069 (p-value 0.021) for sweets, chewing gum, and biscuits. Since in

either case, the coefficients were statistically significant ($P < 0.05$) at the 5percent level, this implies that individuals' health improves due to consumption of pasta and camel meat and taking candies. The findings are in line with [15] that pasta is an important source of carbohydrates, especially starch but also contains vitamins B1 and B2, as well as some minerals. In the same vein, [9], [12] observed that pasta is an important source of high carbohydrates (from 74% to 77%), moderate protein (from 11% to 15%), a food low in sodium, low fat, and cholesterol, and is considered one of the most consumed foods worldwide, suited for a daily balanced diet and often eaten by athletes who participate in long, exhaustive exercises. The improvement in health due to candy consumption could be explained by [10] arguments that chewing sugar-free gum stimulates saliva, which helps to neutralize plaque acids; increase the clearance of sugars, acids, and food debris; and re-mineralize tooth enamel and chewing gum before snacking may reduce hunger, possibly leading to decreased calorie intake from snacks. However, although the camel chews the cud, they do not have split hooves; eating camel meat is naturally and scientifically unclean [6], [25], and may have unforeseen health consequences in the long run.

A negative coefficient of -0.049 (p-value 0.038) for *tinned proteins* (tinned meat, and tinned beans) and -0.019 (p-value 0.014) for *nicotine products* (cigars) which were statistically significant ($P < 0.05$) at the 5percent level, indicates that consumption of tinned proteins like meat and beans and taking nicotine products makes individuals' health deteriorate, similar to findings by [35] that all cigar products deliver significant and addictive quantities of nicotine and carbon monoxide.

CONCLUSIONS

Bad reports particularly chronic illness of a household member; separation (through death, finding work for more than a month, break-up, and sending children to live with relatives); and reduction in disposable income (as a result of household business failure and loss of employment) harm individuals' health by making the health deteriorate. Good reports such as response to severe water shortage/ drought or flood shock through receiving help from the government and receiving help from local or/and international NGOs; and response to death shock through seeking spiritual help leads to an improvement in individuals' health.

Individuals' health improves with the increase in age of an individual, male individuals have worse health compared to their female counterparts and individuals who reside in rural areas have worse health compared to their counterparts who reside in urban areas. Consumption of *white ugali* prepared using *refined*/ sifted maize flour makes an individual's health deteriorate however health improves with the consumption of *brown ugali*; and/ or *white ugali* prepared using *coarse loose maize* taken with dried/smoked fish and traditional vegetables. In addition, an individual's health improves with the consumption of groundnuts, sweet potatoes and other *roots and tubers* including cooking banana, arrow roots, and yams; and consumption of sugarcane, pears, soya drink, and other meats. Individuals' health improves due to the consumption of *fried githeri*; consumption of pasta and camel meat and taking candies. Consumption of *tinned proteins* like meat and beans; taking flavoured fresh milk, lard, preserved fruits and other berries; and taking nicotine products make individuals' health deteriorate.

RECOMMENDATIONS

The government ought to devise more ways of encouraging individuals /households to be deployed by providing financial education and increasing the financial services like the hustler fund project. These will go a long way in reviving their business, ensuring there is no loss of employment as they are no longer employed but deployed, and thus no need to be far away from the household for a prolonged period of time.

The government and both local or/and international NGOs should collaborate in giving a helping hand whenever it calls for a response to severe water shortage/ drought or flood.

Every individual/household ought to have a spiritual authority for seeking spiritual help especially due to chronic illnesses such as the corona (covid-19) virus to cushion the individuals/households from separation experienced through death shocks since some sicknesses are not unto death [20].

More concerted efforts on health education ought to be put in place and promoted to improve the health of male individuals, especially in rural areas.

Individuals need to improve their health by chewing sugarcanes in the morning, taking soya drink or tea prepared using sweet potato leaves with either groundnut, sweet potatoes, cooking banana, arrow roots, and/or yams for breakfast; and/or taking candies in addition to consumption of fruits specifically pears.

Individuals and households ought to be encouraged and empowered to consume *brown ugali* prepared using cassava, sorghum, and millet grain/*wimbi* flour; and/ or *white ugali* prepared using *coarse loose maize* taken with dried/smoked fish with scales, and traditional vegetables, especially during lunchtime.

Individuals and households need to consume *fried githeri* prepared using a mixture of loose maize grain, beans, salt, onion leeks, and cooking fat for their supper or even pasta/ spaghetti.

REFERENCES

1. 1 Thessalonians 5:23. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
2. 3 John 1:2. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
3. Arif, Sania, Batool, Aamina, Nazir, Wahab, Khan, Rao Sanaullah, & Khalid, Nauman. (2019). Physiochemical Characteristics Nutritional Properties and Health Benefits of Sugarcane Juice. In (pp. 226-257).
4. Becker, G. S. (1965). A Theory of the Allocation of Time. *Economic Journal*, 75(299), 493-517.
5. CBK, KNBS, & FSD. (2021). *2021 FinAccess Household Survey*. Retrieved from Nairobi:
6. Deuteronomy 14:7. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
7. Deuteronomy 14:9-10. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
8. Dotto, Joachim, Matemu, Athanasia O, & Ndakidemi, Patrick A. (2018). Potential of cooking bananas in addressing food security in East Africa. *International Journal of Biosciences*, 13(4), 278-294.
9. Duda, Adamina, Adamczak, Julia, Che?mi' nska, Paulina, Juszkiwicz, Justyna, & Kowalczewski, Przemys?aw. (2019). Quality and Nutritional/Textural Properties of Durum Wheat Pasta Enriched with Cricket Powder. *Foods*, 8(46). doi:10.3390/foods8020046
10. Duyff, Roberta L, Birch, Leann L, Byrd-Bredbenner, Carol, Johnson, Susan L, Mattes, Richard D, Murphy, Mary M, . . . Wansink, Brian. (2015). Candy Consumption Patterns, Effects on Health, and Behavioral Strategies to Promote Moderation: Summary Report of a Roundtable Discussion. *American Society for Nutrition. Adv. Nutr*, 6, 139S–146S. doi:10.3945/an.114.007302
11. Ekpa, Onu, Palacios-Rojas, Natalia, Kruseman, Gideon, Fogliano, Vincenzo, & Linnemanna, Anita R. (2019). Sub-Saharan African Maize-Based Foods – Processing Practices, Challenges and Opportunities. *Food Reviews International*, 35(7), 609–639. doi: <https://doi.org/10.1080/87559129.2019.1588290>
12. Espinosa-Solis, Vicente, Zamudio-Flores, Paul Baruk, Tirado-Gallegos, Juan Manuel, Ramírez-Mancinas, Salvador, Olivas-Orozco, Guadalupe Isela, Espino-Díaz, Miguel, . . . Baeza-Jiménez, Ramiro. (2019). Evaluation of Cooking Quality, Nutritional and Texture Characteristics of Pasta Added with Oat Bran and Apple Flour. *Foods*, 8(299), 1-11. doi:10.3390/foods8080299
13. Fauziah, Shofiyatul Mas'udah, Hapsari, Lia, & Nurfadilah, Siti (2020). Biochemical Composition and Nutritional Value of Fresh Tuber of Water Yam (*Dioscorea alata* L.) Local Accessions from East

- Java, Indonesia. *AGRIVITA Journal of Agricultural Science*, 42(2), 255–271. doi: <https://doi.org/10.17503/agrivita.v0i0.2552>
14. Genesis 1:26. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
 15. Giacco, R, Vitale, M, & Riccardi, G. (2016). Pasta: Role in Diet. In B. Caballero, P. Finglas, & F. Toldrá (Eds.), *The Encyclopedia of Food and Health* (Vol. 4, pp. 242-245). Oxford: Academic Press.
 16. Holdsworth, Michelle, Pradeilles, Rebecca, Tandoh, Akua, Green, Mark, Wanjohi, Milkah, Zotor, Francis, . . . Laar, Amos. (2020). Unhealthy eating practices of city-dwelling Africans in deprived neighbourhoods: Evidence for policy action from Ghana and Kenya. *Global Food Security*, 26
 17. Islam, Shahidul. (2007). Nutritional and Medicinal Qualities of Sweet potato Tops and Leaves. In *Plant Science* (pp. 4). University of Arkansas at Pine Bluff: Cooperative Extension Service Printing Services.
 18. Ji, Hua, Zhang, Haixin, Li, Hongtao, & Li, Yunchao. (2015). Analysis on the Nutrition Composition and Antioxidant Activity of Different Types of Sweet Potato Cultivars. *Food and Nutrition Sciences*, 6 , 161-167.
 19. Job 4:14. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
 20. John 11:4. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
 21. KNBS.(2019). *Kenya Population and Housing Census*. Nairobi: Government Printer
 22. KNBS.(2020). *Economic Survey 2020*. Nairobi: Government Printer
 23. KNBS.(2021). *Economic Survey 2021*. Nairobi: Government Printer
 24. KNBS.(2022). *Economic Survey 2022*. Nairobi: Government Printer
 25. Leviticus 11:4. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
 26. Leviticus 11:9-10. (1982). The Holy Book. In *New King James Version (NKJV)*. Nashville, TN: Thomas Nelson Publishers.
 27. Ministry of Health. (2014). *Health Sector Human Resources Strategy 2014-2018*. Nairobi, Kenya: Government of Kenya
 28. Ministry of Health. (2015). *Kenya Health Workforce Report: The Status of Healthcare Professionals in Kenya, 2015*. Nairobi, Kenya: Government of Kenya
 29. Ministry of Health. (2017). *National Guidelines for Healthy Diets and Physical Activity*. Nairobi, Kenya: Government of Kenya
 30. Ministry of Health. (2019). *Kenya National Health Accounts 2015/2016*. Nairobi, Kenya: Government of Kenya
 31. Morton, Darren, Rankin, Paul, Kent, Lillian, Sokolies, Rex, Dysinger, Wayne, Gobble, John, & Diehl, Hans. (2014). The Complete Health Improvement Program (CHIP) And Reduction of Chronic Disease Risk Factors in Canada. *Canadian Journal of Dietetic Practice and Research*, 75(2), 71-77. doi:10.3148/75.2.2014.72
 32. Muthama, Thomas Mutinda (2018). Household Production of Human Health in Kenya: An Econometric Analysis. *International Journal of Science and Research (IJSR)*, 7(12), 960-965. doi:10.21275/ART20193803
 33. Muthama, Thomas Mutinda, & Mutiso, Stephen Kyalo. (2019). Demand for Dental Health Care in Kenyan Households. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 18(6 Ser. 15), 41-45. doi:10.9790/0853-1806154145
 34. Muthama, Thomas Mutinda, Mutiso, Stephen Kyalo, & Munguti, Daniel M. (2021). A Health Production Approach to Bone Health in Kenya. *Journal of Health, Medicine and Nursing*, 85, 96-109. doi:10.7176/JHMN/85-15
 35. Pickworth, Wallace B, Rosenberry, Zachary R, O’Grady, Kevin E, & Koszowski, Bartosz. (2017). Dual Use of Cigarettes, Little Cigars, Cigarillos, and Large Cigars: Smoking Topography and Toxicant Exposure. *Tobacco Regulatory Science*, 3, S72-S83.
 36. Proverbs 16:24. (1982). The Holy Book. In *New Living Translation (NLT)*. Nashville, TN: Thomas

Nelson Publishers.

37. Kenya Gazette Supplement No. 101 The Health Act No. 21, 415-483 (The Government Printer, Nairobi 2017).
38. Serrem, Kevin, Dunay, Anna, Serrem, Charlotte, Atubukha, Bridget, Oláh, Judit, & Bálint Illés, Csaba. (2020). Paucity of Nutrition Guidelines and Nutrient Quality of Meals Served to Kenyan Boarding High School Students. *Sustainability*, 12(3463). doi:10.3390/su12083463
39. Singh, Shweta, & Kunwar, Neelma. (2018). Highly nutritive value of groundnut and benefit for health. *International Journal of Food Science and Nutrition*, 3(5), 124-126.
40. Wanjala, W. G, Onyango, A, Makayoto, M, & Onyango, C. (2016). Indigenous technical knowledge and formulations of thick (ugali) and thin (uji) porridges consumed in Kenya. *African Journal of Food Science*, 10(12), 385-396