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| RESEARCH ARTICLE

Income Distribution and Its Effect on Food Expenditure, Non-Food Expenses and Savings in Households of a Developing Economy

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| ABSTRACT
The study examined the income distribution and effects of income on food expenditure, non-food expenditure and savings of households. The survey data was used, and Gini-coefficient was derived from observing the income distribution across households of different income classes. Engel coefficient was used to estimate the income elasticity of the expenditure on food items. This study found significant disparities in the income of rich and poor households with a high Gini Index. Also, it found significant variations in food consumption patterns across different income classes. The proportion of food basket share of a household declined with an increase in income. Similarly, the proportion of the budget share of food items shifted to other non-food items with increased income. According to the findings, lower income households had a higher elasticity of food expenditure than higher income households, complying with Engel's law. The results of this study are noteworthy because they would provide crucial policy recommendations and a foundation for future research.

| KEYWORDS
Income distribution; expenditure elasticity; income groups; Lorenz curve; Gini-coefficient; Engle curve; Engel coefficient; food expenditure, Nepal.

| ARTICLE INFORMATION
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1. Introduction
This study aimed to explore the various dimension of a developing economy based on the household survey data of selected semi-urban communities of Nepal with reference to household income, consumption and the structure of the economy. The outcome of this paper would be beneficial for economic planning. To analyze the economy, some specific measures were used, namely Gini Index, Gini Coefficient, Lorenz Curve, Engel's Law, Engel Coefficient and Engel Curve.

2. Literature Review
2.1 The Gini Index or Gini Coefficient and Lorenz Curve
The Italian statistician Corrado Gini created the Gini index or Gini coefficient as a scientific measurement of distribution in 1912 (Ceriani & Verme, 2012). It measures the distribution of income in a population and serves as a barometer of economic inequality. Its value is from 0 to 1, where 0 represents perfect equality, and 1 represents ideal inequality.

The income (or consumer spending) inequality of an economy is measured by the Gini index (Druckman & Jackson, 2008). A Lorenz curve shows cumulative percentages of total revenue vs cumulative beneficiaries, starting with the lowest person or household (Lambert, 1992). The Gini index calculates the difference between a fictitious absolute equality line and the Lorenz curve as a percentage of the area under the line.

A value of 100 denotes perfect inequality, while a value of 0 for the Gini coefficient denotes perfect equality (Indexmundi, 2019). In other words, the Gini coefficient is a crucial instrument for examining the distribution of income or wealth within a nation, region,

or territory. If everyone has the same income, then it will be 0. If one person has all the money, it will be 1 (World Bank, 2020). The Gini Index of Nepal is reported high.

2.2 Engel Coefficient and Engel Curve

An economic theory known as Engel's Law describes the connection between household income and a certain good or service expenditure (Zimmerman, 1932). Engel (1857) discovered that while food budget shares drop with income, food expenditures increase as a function of both income and family size. Because poorer households devote a larger percentage of their income to food than wealthier households, even if actual food expenditures rise, the portion of income spent on food is inversely proportional to income level.

It asserts that when household income increases, the percentage of income spent on food decreases. German economist and statistician Ernst Engel first proposed the theory in 1857. He is renowned for the Engel curve in microeconomics in addition to Engel's Law.

Engel's Law states that as income rises, food spending decreases even when the total amount spent on food continues to rise (Houthakker, 1957). Engel's Law does not presuppose that when family income rises, food spending will also grow. For instance, if a household has a monthly income of $X and spends $X (Y% of that income) on food, and if that family's income improves by Y%, they would now spend $X+x on food (but (Y-y)% of their increased income (I+i)). Despite an increase in food spending of z% in absolute terms, the relative income proportion falls to (Y-y)%. The drop in proportion can be attributed to a slower rate of increase in food expenses compared to income growth.

The theory, which may be applied nationally, suggests that industrialized nations with higher average family incomes spend less of their income on food than emerging nations with lower incomes, as indicated by the Engel coefficient. The Engel coefficient of a nation reveals its economic standing. A declining Engel coefficient typically denotes a country's economic expansion and rising income level. In contrast, a rising Engel coefficient denotes a decline in a nation's level of income (Laitner, 2000).

The Engel curve, which is based on Engel's Law, is a derivative idea. The Engel curve explains how expense on a certain item fluctuates with the income of the household, either proportionally or in terms of absolute dollars (Kaus, 2013). Demographic factors, including age, gender, and educational attainment, as well as other consumer traits, have an impact on how an Engel curve looks.

With regard to other items, the Engel curve also differs. Engel curves with expenditures on the y-axis and income level on the x-axis show increasing slopes for average commodities with a positive income elasticity of demand. The Engel curves for inferior commodities have negative slopes and negative income elasticity. The Engel curve for food has a positive but decreasing slope and is concave downhill.

3. Methodology

In the research on the proportion of household income spent on the acquisition of food and non-food commodities as well as savings, researchers have applied Engels laws, Engels coefficients, Engel curves, ANOVA models and the R^2 value of such models.

3.1 Types of Data and Sources

The study used real household data and analyzed household economy in rupees, which consists of 75 households in selected semi-urban communities of Nepal. The household level economic data, including income, expenditure across food items, non-food items and savings, were collected and analyzed by classifying the income class into five income classes (wealthy, upper middle, middle, lower middle, poor).

3.2 Ethical Considerations

Informed consent was obtained from the household respondents to participate in the study. The identity of the respondents has been anonymized. The Declaration of Helsinki was followed throughout the study.

3.3 Methods Used for Data Analysis

Further to our perusal of income by income groups, we derived *Gini-coefficient* and *Lorenz curves* to observe the distribution of income. These measures were derived based on the information and methodology explained in PovcalNet (World Bank, 2021). We also derived *Engel Coefficient* by income group to observe the proportion of change in food expenditure with the change in income across different income groups.

To estimate the variation in the Engel Coefficient with change in the price of the food basket and constant income, we compared the Engel Coefficient of each income class before and after the increment of the price of the food basket by 10%. Then, we calculated the average food expenditure, average non-food expenditure and average savings by each income class. We also compared these indicators (average food expenditure, average non-food expenditure and average saving) of each income class before and after the increment of the price of the food basket by 10% with constant income.

While analyzing the data, we used tables with descriptive statistics (average, ration, percentage), bar graphs, pie-chart and line graphs for presenting the data. In certain cases, we also applied statistical analysis, such as the ANOVA test, to compare the average value of the indicators for different income groups. The obtained results supported the arguments from the perspectives of household welfare considering non-food consumption and saving as food consumption rises, which creates pressure on nonfood consumption.

4. Results

4.1 Income Distribution of Households

Sorting the collected household data, the income groups were ranked into five classes (wealthy, upper middle, middle, lower middle, and poor). Then the average income, variation of income, range of income with minimum/maximum value, the sum of income and its share were calculated by income groups.

Table 1: Average income, variation of income, range of income with minimum/maximum value, sum of income and its share by income groups.

Income Group	N (%)	Mean	Std. Dev.	Min	Max	Sum	Range	% of Total Sum
Wealthy	15(20)	138631	75702	77300	300000	2079466	222700	47
Upper middle	15(20)	62276	6356	53000	73000	934133	20000	21
Middle	15(20)	437789	5595	35333	51000	656683	15667	15
Lower Middle	15(20)	31290	2764	27000	35100	469350	8100	10
Poor	15(20)	17841	5271	10000	25500	267617	15500	6
Total	75(100)	58763	54203	10000	300000	4407250	290000	100

Table 1 shows that the mean income of households significantly increased between the income groups moving upwards from poor to wealthy households. Similarly, one-fifth of wealthy households hold the largest income share (half of the total income).

Fig. 1: Actual Income Distribution among Different Groups

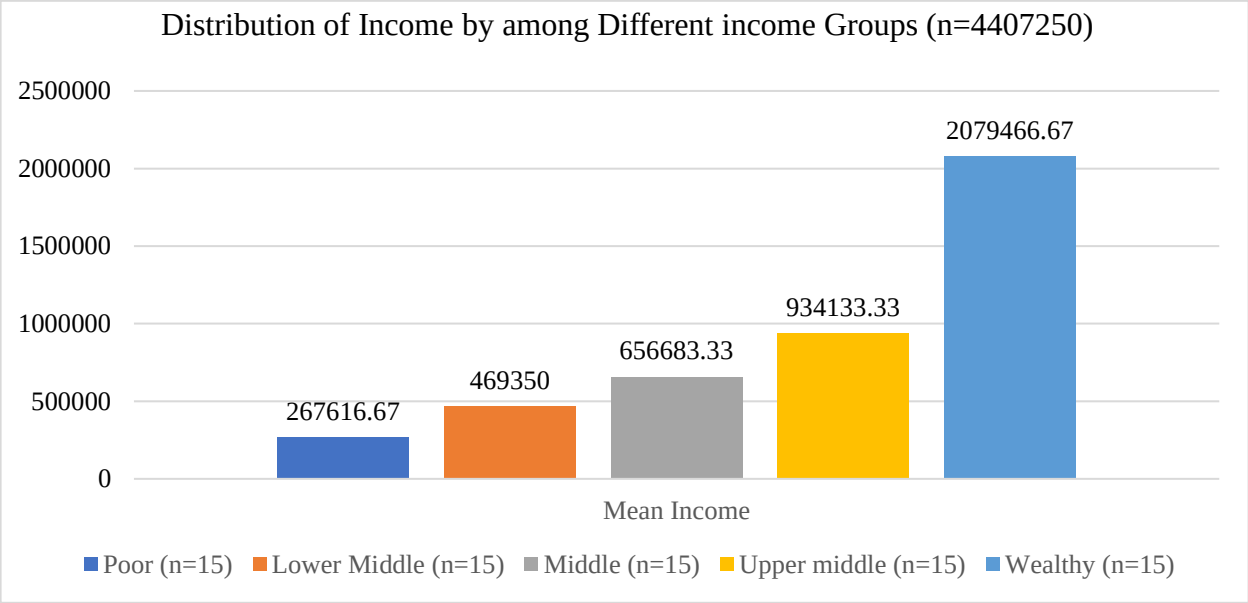

Fig. 1 shows that the mean income of households significantly increased between the income groups moving upwards from poor to wealthy households. Similarly, one-fifth of wealthy households hold the largest income share (half of the total household income).

Fig. 2: Percentage Distribution of Income among Different Groups (%)

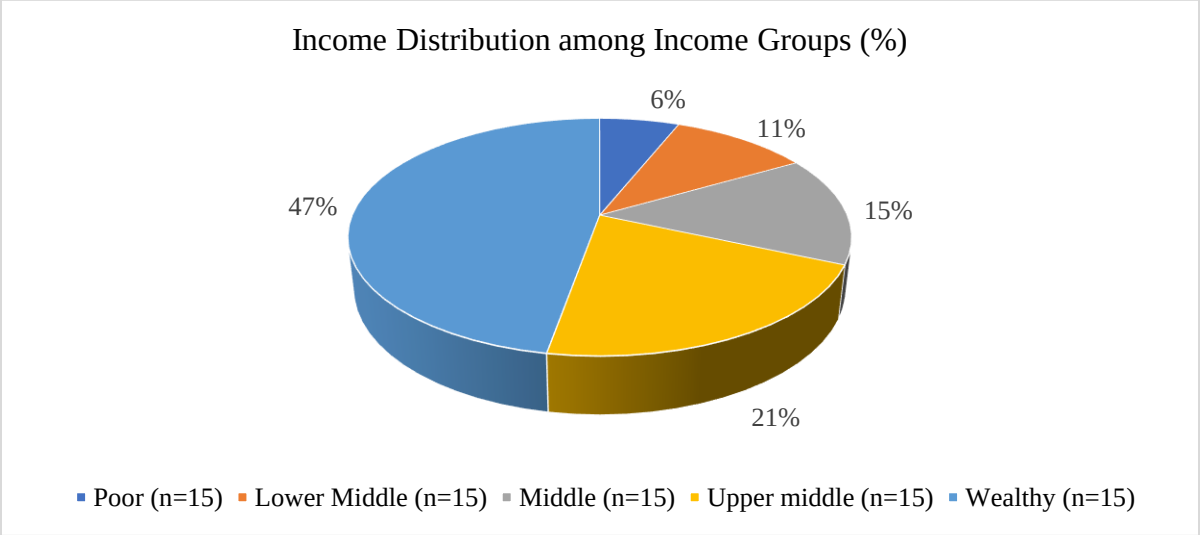

Fig 2 shows that the richest 25% of households hold nearly half (47%) of total household income, whereas the poorest 25% of households hold only 6% of total household income showing wide gaps and inequalities of income between rich and poor.

Fig. 3: Lorenz Curve and Gini-Coefficient for Income Distribution among Different Groups: Measures of Inequality

Fig 3 derives Lorenz Curve and Gini-Coefficient for income distribution among the different groups as a measure of income equality. The value of Gini-Coefficient is 0.371. This means a 37% percent concentration in the income distribution, showing a significant gap in the income that every household receives and wide income gaps between poor and rich households.

Table 2: One-way ANOVA for Test of Significance of Mean Income of Households of Different Income Groups

			Sum of Squares	df	Mean Square	F	Sig.
Total income * Income Group	Between Groups	(Combined)	135677152852	4	33919288213	29.051	.000
		Linearity	111437973113	1	111437973113	95.443	.000
		Deviation from Linearity	24239179739	3	8079726580	6.920	.000
	Within Groups		81731309926	70	1167590142		
	Total		217408462778	74			

Table 2 shows the one-way ANOVA for a test of significance of the mean income of households of different income groups, demonstrating that the income of households significantly increased between the income groups moving upwards from poor to wealthy households (P<0.01).

Table 3: Model for Measures of Association of Total Income by Income Groups

	R	R Squared	Eta	Eta Squared
Total income * Income Group	-0.716	0.513	0.790	0.624

Table 3 shows that the value of R^2 for estimates of the model was 51%, which is considerably high. This means that the significantly different income distribution between the classified income groups of households explains the variation in income inequality sufficiently.

4.2 Existing Food Consumption of Households

Table 4: Average food expenditure, variation of food expenses, range of food expenses with minimum/maximum value, sum of food expenses and its share by income groups.

Income Group	N (%)	Mean	Std. Dev.	Min.	Max.	Range	Sum	% of Total Sum
Wealthy	15(20)	10407	3580	6435	19800	13365	156105	27
Upper middle	15(20)	9107	2300	5750	12600	6850	136602	24
Middle	15(20)	6883	2488	4120	12050	7930	103240	18
Lower Middle	15(20)	6389	1887	3625	9385	5760	95835	17
Poor	15(20)	5486	1954	2600	9675	7075	82284	14
Total	75(100)	7654	3059	2600	19800	17200	574066	100

Table 4 shows the average food expenditure, variation of food expenses, range of food expenses with minimum/maximum value, the sum of food expenses and its share by income groups. Accordingly, the proportion of expenditure on food consumption to the income of households significantly decreased, moving from poor to wealthy households and the poor share the greatest portion of their income on food items.

Table 5: One-way ANOVA for Test of Significance of Mean Expenditure of Food Consumption by Households of Different Income Groups

			Sum of Squares	df	Mean Square	F	Sig.
Food * Income Group	Between Groups	(Combined)	248800661	4	62200165	9.818	.000
		Linearity	236652171	1	236652171	37.354	.000
		Deviation from Linearity	12148490	3	4049497	.639	.592
	Within Groups		443478963	70	6335414		
	Total		692279623.505	74			

Table 5 shows the one-way ANOVA for a test of the significance of mean expenditure of food consumption by households of different income groups. The test concluded by demonstrating that the proportion pf expenditure of food consumption to the income of households significantly decreased, moving from poor to wealthy households (P<0.01).

Table 6: Model for Measures of Association of Total Food Expenditure by Income Groups

	R	R Squared	Eta	Eta Squared
Food Expenditure* Income Group	-0.585	0.342	0.599	0.359

Table 6 shows that the value of R^2 for estimates of the model was 51%, which is considerably high. This means that the significantly different income distribution between the classified income groups of households explains the variation in income inequality sufficiently.

4.3 Engel Coefficient

Engel co-efficient represents the proportion of household income spent on food. Engel Law was founded by a German statistician. It states that as income rises, a household spends less on food and more on other commodities like luxury items.

Table 7: Engel Coefficient by income group

Income Group	N (%)	Mean	Std. Deviation	Minimum	Maximum	Range	Sum	% of Total Sum
Wealthy	15 (20)	0.084	0.028	0.043	0.132	0.089	1.266	9
Upper middle	15 (20)	0.147	0.039	0.090	0.210	0.119	2.208	16
Middle	15 (20)	0.155	0.044	0.105	0.241	0.136	2.33	17
Lower Middle	15 (20)	0.206	0.065	0.116	0.335	0.219	3.086	23
Poor	15 (20)	0.310	0.076	0.153	0.496	0.342	4.655	34
Total	75 (100)	0.181	0.092	0.043	0.496	0.453	13.546	100

Table 7 shows the average of the Engel Coefficient with variance, minimum and maximum values, range, and percentage of share of the sum income spent on food. The Engel co-efficient was determined by the proportion of average income spent on food consumption by each group of households. The poorest households invest the highest share of their income in food consumption (31%) as compared to the lowest share of the income of the wealthiest (8%). This supports Engel's law demonstrating that an increase in income has led to a decrease in the proportion spent on food consumption. Similarly, the poorest households contribute to the highest share of investment in food consumption (34%) as compared to the lowest contribution of (9%) wealthiest households. This indicates that as the income increases, its proportion spent on food decreases and vice versa.

Table 8: One-way ANOVA for Test of Significance of Engel Coefficient by Households of Different Income Groups

			Sum of Squares	df	Mean Square	F	Sig.
Engel Coefficient * Income Group	Between Groups	(Combined)	0.427	4	0.107	37.442	0.000
		Linearity	0.391	1	0.391	137.045	0.000
		Deviation from Linearity	0.036	3	0.012	4.241	0.008
	Within Groups		0.199	70	0.003		
	Total		0.626	74			

Table 8 shows the ANOVA test for a test of the significance of the Engel coefficient by households of different income groups. Accordingly, the average proportion of the income spent on food by poor households was significantly higher than that of rich

households. Similarly, the share of investment in food consumption contributed by the poorest households was significantly higher than that contributed by wealthy households. Both of the scenarios support Engel's law.

Table 9: Model for Measures of Association of Engel Coefficient by Income Groups

	R	R Squared	Eta	Eta Squared
Engel Coefficient * Income Group	0.790	0.624	0.826	0.681

Table 9 shows that the value of R^2 for estimates of the model was 79%, which is quite high. High values of R^2 here mean that the income group explain the variation in food expenditure of households sufficiently.

4.4 Food Consumption of Households after Increment of the Price of the Food Basket

Table 10: Engel Coefficient by Income Class After Increment of the Price of the Food Basket by 10% with Constant Income.

Income Group	% of Total N	Mean	Std. Deviation	Minimum	Maximum	Range	Sum	% of Total Sum
Wealthy	20.0%	0.093	0.030	0.048	0.146	0.098	1.393	9
Upper middle	20.0%	0.162	0.043	0.099	0.231	0.132	2.429	16
Middle	20.0%	0.171	0.048	0.116	0.265	0.149	2.564	17
Lower Middle	20.0%	0.226	0.071	0.128	0.369	0.241	3.394	23
Poor	20.0%	0.341	0.084	0.169	0.545	0.377	5.120	35
Total	100.0%	0.199	0.101	0.048	0.545	0.498	14.901	100

Table 10 shows the average of the Engel Coefficient with variance, minimum and maximum values, range, and percentage of share of the sum income spent on food after an increment of the price of the food basket by 10% with constant income. The Engel co-efficient was determined by the proportion of average income spent on food consumption by each group of households after an increment of the price of the food basket by 10% with constant income. The poorest households invest the highest share of their income in food consumption (35%) as compared to the lowest share of the income of the wealthiest (9%). This supports Engel's law demonstrating that an increase in income leads to a decrease in the proportion spent on consumption. Similarly, the poorest households contribute to the highest share of investment in food consumption (35%) as compared to the lowest contribution of (9%) wealthiest households. This indicates that as the income increases, its proportion spent on food decreases and vice versa.

Fig. 4: Curve Showing Decreased Relative Proportion of Expenditure on Food with Increased Income.

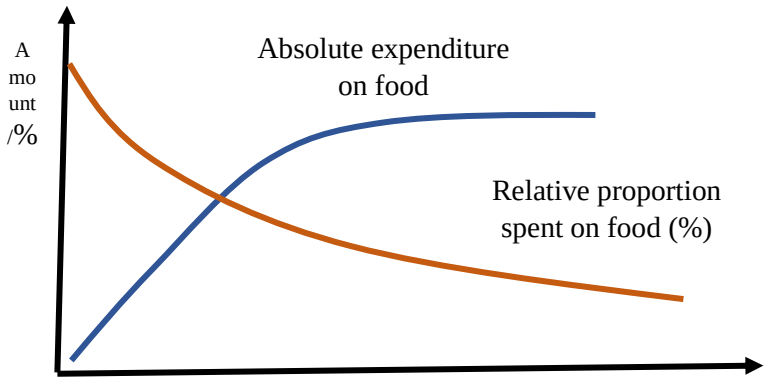

Fig. 4 shows the decreased relative proportion of expenditure on food consumption with increased income despite the increment observed in absolute expenditure on food.

Table 11: One-way ANOVA for Test of Significance of Engel Coefficient by Households of Different Income Groups after increment of the price of the food basket by 10% with constant income

			Sum of Squares	df	Mean Square	F	Sig.
Engel Coeff_Food10 * Income Group	Between Groups	(Combined)	0.516	4	0.129	37.442	.000
		Linearity	0.473	1	0.473	137.045	.000
		Deviation from Linearity	0.044	3	0.015	4.241	.008
	Within Groups		0.241	70	0.003		
	Total		0.758	74			

Table 11 shows the one-way ANOVA for a test of the significance of the mean expenditure of the Engel coefficient by households of different income groups after an increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of expenditure on food consumption to the income of households significantly decreased, moving from poor to wealthy households ($P<0.01$), strongly supporting Engel's law.

Table 12: Model for Measures of Association of Engel Coefficient by Income Groups after increment of the price of the food basket by 10% with constant income

	R	R Squared	Eta	Eta Squared
Engel Coeff_Food10 * Income Group	0.790	0.624	0.826	0.681

Table 12 shows that the value of R^2 for estimates of the model was 62%, which is quite high. High values of R^2 here mean that the income group explain the variation in the change in food expenditure out of the income of households by variation in income sufficiently.

4.5 Comparison of Engel Coefficient Before after Increment of the Price of the Food Basket

Fig. 5: Comparison of Engel Coefficient by each income class before and after increment of the price of the food basket by 10% with constant income.

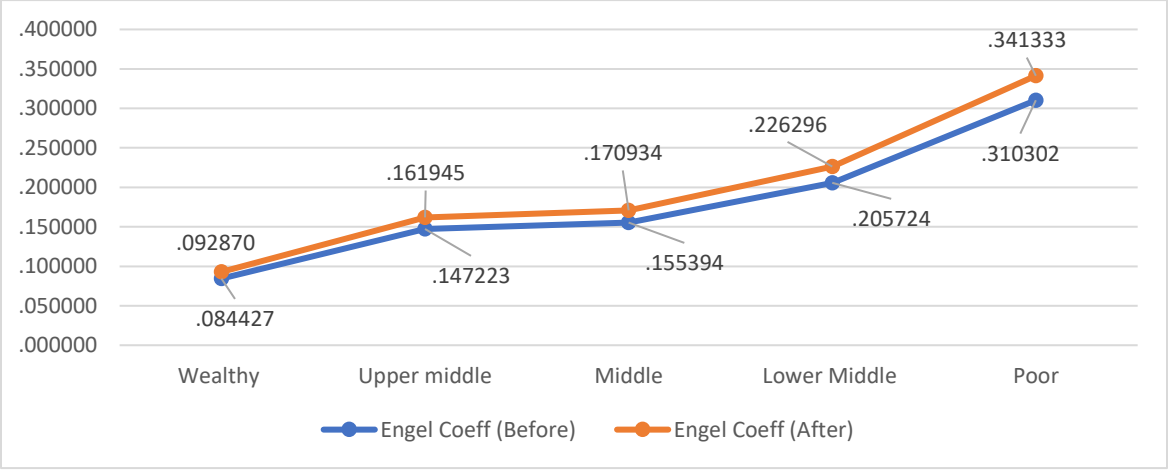

Fig 5 shows the pattern of the mean Engel Coefficient by households of different income groups after an increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of expenditure on food consumption to the income of households decreased, moving from poor to wealthy households, again supporting Engel's law.

Fig. 6: Comparison of Engel Coefficient (in percentage) by income groups before and after increment of the price of the food basket by 10% with constant income.

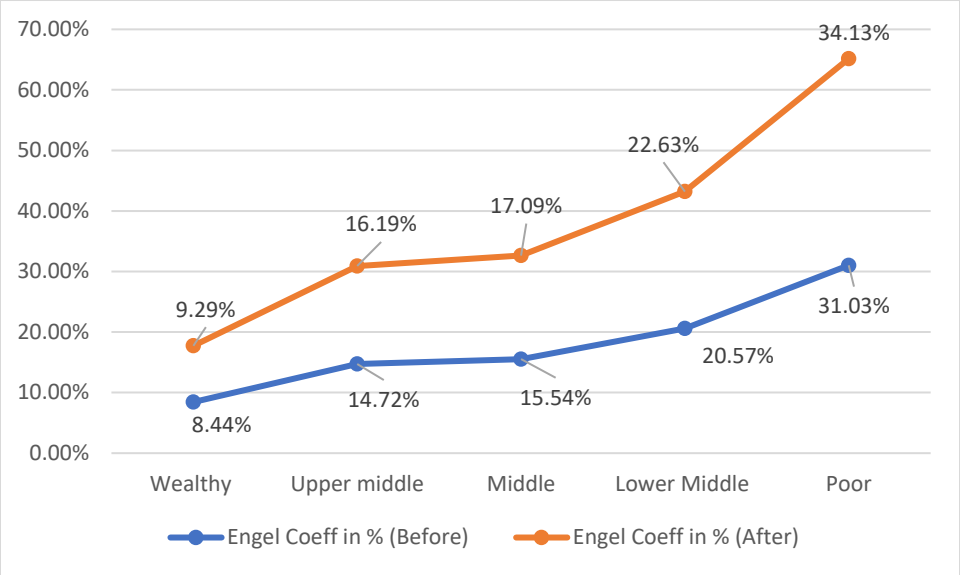

Fig 6 shows the pattern of change of the Engel coefficient (in percentage) by households of different income groups after an increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of expenditure on food consumption to the income of households significantly decreased, moving from poor to wealthy households and widening the gap between the lines further, strongly supporting Engel's law.

4.6 Existing Status of Food Expenditure, Non-Food Expenditure and Average Savings

Table 13: Average food expenditure, Average non-food expenditure and Average saving by each income class

Income Group		Food Expenditure	Non-food Expenditure	Average Savings
Wealthy	Mean	10407	58346	69878
	Std. Deviation	3580	41747	39504
	Minimum	6435	21960	12293
	Maximum	19800	175262	162303
Upper middle	Mean	9107	24437	28731
	Std. Deviation	2300	8002	10888
	Minimum	5750	8665	7877
	Maximum	12600	41023	48368
Middle	Mean	6883	23586	13311
	Std. Deviation	2488	8644	8330
	Minimum	4120	7010	4055
	Maximum	12050	38945	35970
Lower Middle	Mean	6389	14967	9934
	Std. Deviation	1887	4910	4977
	Minimum	3625	5520	3210
	Maximum	9385	25485	19605

Poor	Mean	5486	8640	3715
	Std. Deviation	1954	4274	2858
	Minimum	2600	2303	793
	Maximum	9675	15885	11320
Total	Mean	7654	25995	25114
	Std. Deviation	3059	25759	30226
	Minimum	2600	2303	793
	Maximum	19800	175262	162303

Table 13 shows the actual mean food consumption, non-food consumption and saving by income groups by households of different income groups before the increment of the price of the food basket by 10%, keeping the income constant. Accordingly, i) the proportion of expenditure on food consumption to the income of households decreased, moving from poor to wealthy households, ii) the proportion of non-food expense to the income of households significantly increased, moving from poor to wealthy households, and iii) the proportion of saving to the income of households significantly increased moving from poor to wealthy households, widening the inequality further and strongly supporting the Engel's law.

Table 14: One-way ANOVA for Test of Significance of Food Consumption, Non-Food Consumption and Saving by Income Groups

			Sum of Squares	df	Mean Square	F	Sig.
Food consumption * Income Group	Between Groups	(Combined)	248800661	4	62200165	9.818	0.000
		Linearity	236652171	1	236652171	37.354	0.000
		Deviation from Linearity	12148490	3	4049497	.639	0.592
	Within Groups		443478963	70	6335414		
	Total		692279624	74			
Non-food consumption before * Income Group	Between Groups	(Combined)	22164903933	4	5541225983	14.401	0.000
		Linearity	17783348640	1	17783348640	46.215	0.000
		Deviation from Linearity	4381555293	3	1460518431	3.796	0.014
	Within Groups		26935464028	70	384792343		
	Total		49100367962	74			
Total savings before * Income Group	Between Groups	(Combined)	42667823398	4	10666955850	29.939	0.000
		Linearity	34256667429	1	34256667429	96.148	0.000
		Deviation from Linearity	8411155969.760	3	2803718656.587	7.869	0.000
	Within Groups		24940276520.400	70	356289664.577		
	Total		67608099918.667	74			

Table 14 shows the one-way ANOVA to test of significance of mean food consumption, non-food consumption and saving by income groups by households of different income groups before the increment of the price of the food basket by 10%, keeping the income constant. Accordingly, i) the proportion of expenditure on food consumption to the income of households significantly decreased moving from poor to wealthy households ($P<0.01$), ii) the proportion of non-food expense to the income of households

significantly increased moving from poor to wealthy households (P<0.01), and iii) the proportion of saving to the income of households significantly increased moving from poor to wealthy households (P<0.01), widening the inequality further and strongly supporting the Engel's law.

Table 15: Measures of Association for Food Consumption, Non-Food Consumption and Saving by Income Groups

	R	R Squared	Eta	Eta Squared
Food Consumption * Income Group	-0.585	0.342	0.599	0.359
Non-food consumption before * Income Group	-0.602	0.362	0.672	0.451
Total savings before * Income Group	-0.712	0.507	0.794	0.631

Table 15 shows the value of R^2 for estimates of the model testing the association of food consumption, non-food consumption and saving by income groups, which were 34%, 36% & 50%, respectively. These values of R^2 mean that the income strata explain the variation in the change in food consumption, non-food consumption and saving sufficiently.

Fig. 7. Food Expenditure, Non-Food Expenditure and Savings by Income Group

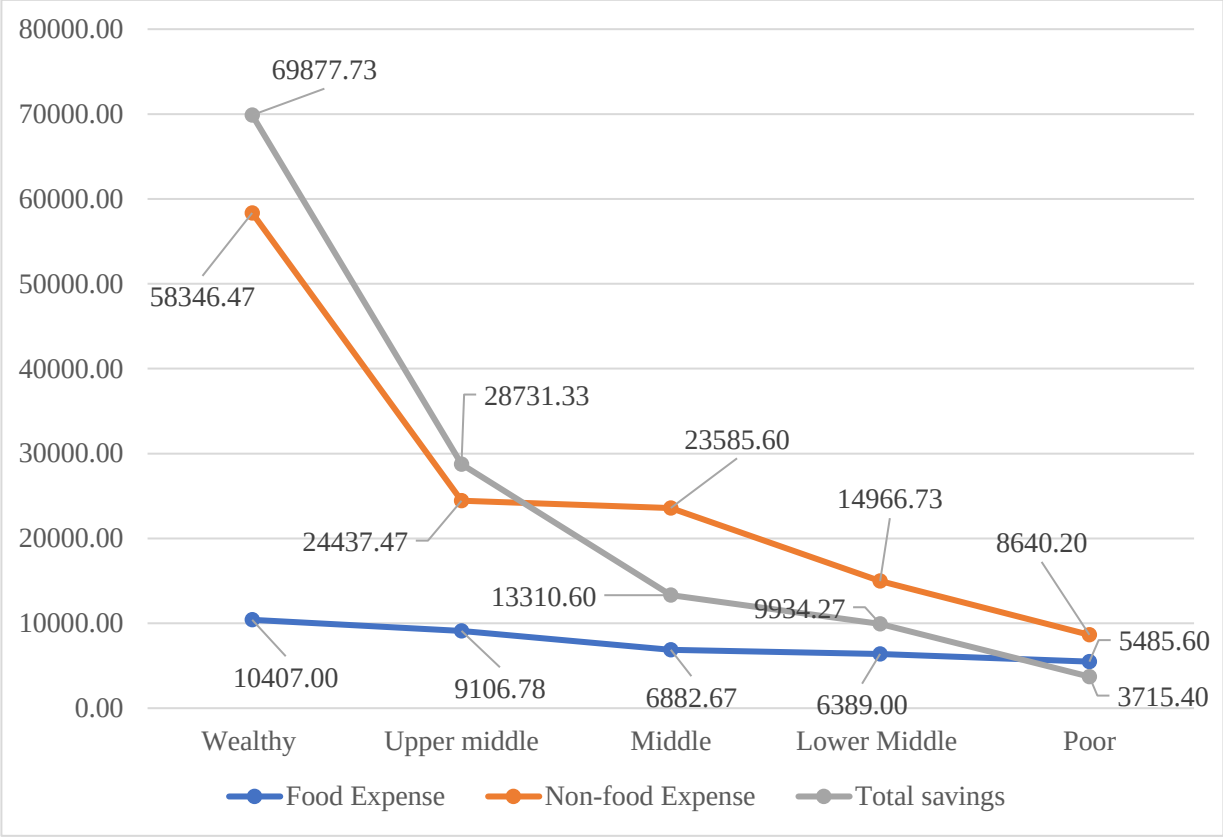

Fig 7 shows the actual pattern of mean food consumption, non-food expenditure and saving for different income groups of households before the increment of the price of the food basket. Accordingly, i) the proportion of expenditure on food consumption to the income of households decreased moving from poor to wealthy households and strongly supported Engel's law, ii) the proportion of non-food expense to the income of households significantly increased moving from poor to wealthy households, widening the gaps and iii) the proportion of saving to the income of households significantly increased moving from poor to wealthy households, widening the inequality of saving a proportion of income further between poor and rich households.

4.7 Comparison of Average food expenditure before and after increment of the price of the food basket

The data shows that i) the proportion of expenditure on food consumption to the income of households decreased, moving from poor to wealthy households, strongly supporting Engel's law

Table 16: Comparison of Average Food Consumption by Income Groups Before and After Increment in the Price of Food Baskets by 10%

Income Group		Food Expenditure before	Food Expenditure after
Wealthy	Mean	10407	11448
	Std. Deviation	3580	3938
Upper middle	Mean	9107	10018
	Std. Deviation	2301	2530
Middle	Mean	6883	7571
	Std. Deviation	2488	2737
Lower middle	Mean	6389	7028
	Std. Deviation	1887	2075
Poor	Mean	5486	6034
	Std. Deviation	1954	2149
Total	Mean	7654	8420
	Std. Deviation	3058	3364

Table 16 shows the mean expenditure on food consumption by income groups by households of different income groups before and after the increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of expenditure on food consumption to the income of households decreased, moving from poor to wealthy households before and after the increment of the price of the food basket by 10% while keeping the income constant, supporting Engel's law.

Table 17: One-way ANOVA for Test of Significance of Food Consumption by Income Groups Before and After Increment in the Price of Food Basket by 10%

			Sum of Squares	df	Mean Square	F	Sig.
Food * Income Group	Between Groups	(Combined)	248800661	4	62200165	9.818	.000
		Linearity	236652171	1	236652171	37.354	.000
		Deviation from Linearity	12148490	3	4049497	.639	.592
	Within Groups		443478963	70	6335414		
	Total		692279624	74			
Food_10% * Income Group	Between Groups	(Combined)	301048800	4	75262200	9.818	.000
		Linearity	286349127	1	286349127	37.354	.000
		Deviation from Linearity	14699673	3	4899891	.639	.592
	Within Groups		536609545	70	7665851		
	Total		837658344	74			

Table 17 shows the one-way ANOVA for a test of the significance of mean food consumption by income groups by households of different income groups before and after an increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of expenditure on food consumption to the income of households significantly decreased, moving from poor to wealthy households before and after the increment of the price of the food basket by 10%, keeping the income constant ($P<0.01$), strongly supporting the Engel's law.

Table 18: Measures for Association of Food Consumption by Income Groups Before and After Increment in the Price of Food Basket by 10%

	R	R Squared	Eta	Eta Squared
Food Consumption * Income Group	-0.585	0.342	0.599	0.359
QAFood_10% * Income Group	-0.585	0.342	0.599	0.359

Table 18 shows the value of R^2 for estimates of the model testing the association of food consumption by income groups before and after the increment in the price of food baskets by 10%, which was 34% in each of the cases. These values of R^2 mean that the income strata explain the variation in the change in food consumption in case of any increment sufficiently.

4.8 Comparison of average non-food expenditure before and after increment of the price of the food basket

The data underpins that the proportion of non-food expenses to the income of households significantly increased, moving from poor to wealthy households and shifting the proportion of expenses to income from food items to luxury items.

Table 19: Average Saving of Income Groups Before and After Increment in the Price of Food Baskets by 10%.

Report			
Income Group		Total savings before	Total savings after
Wealthy	Mean	69877.73	68837.00
	Std. Deviation	39504.254	39250.419
Upper middle	Mean	28731.33	27820.60
	Std. Deviation	10887.828	10972.208
Middle	Mean	13310.60	12622.47
	Std. Deviation	8329.483	8407.538
Lower middle	Mean	9934.27	9295.53
	Std. Deviation	4976.777	5014.232
Poor	Mean	3715.40	3166.87
	Std. Deviation	2858.116	2847.020
Total	Mean	25113.87	24348.49
	Std. Deviation	30226.197	30038.130

Table 19 shows the average saving by income groups of households of different income groups before and after the increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of saving to the income of households significantly increased, moving from poor to wealthy households before and after the increment of the price of the food basket by 10%, keeping the income constant, widening the inequality in income distribution further.

Table 20: One-way ANOVA for Test of Significance of Savings by Income Groups Before and After Increment in the Price of Food Basket by 10%

			Sum of Squares	df	Mean Square	F	Sig.
Total savings before * Income Group	Between Groups	(Combined)	42667823398	4	10666955850	29.939	0.000
		Linearity	34256667429	1	34256667429	96.148	0.000
		Deviation from Linearity	8411155970	3	2803718657	7.869	0.000
	Within Groups		24940276520	70	356289665		

	Total		67608099919	74			
Total savings after * Income Group	Between Groups	(Combined)	42060530468	4	10515132617	29.789	0.000
		Linearity	33689427203	1	33689427203	95.442	0.000
		Deviation from Linearity	8371103265	3	2790367755	7.905	0.000
	Within Groups		24708872493	70	352983893		
	Total		66769402961	74			

Table 20 shows the one-way ANOVA for a test of the significance of average saving by income groups by households of different income groups before and after an increment of the price of the food basket by 10%, keeping the income constant. Accordingly, the proportion of saving to the income of households significantly increased, moving from poor to wealthy households before and after the increment of the price of the food basket by 10%, keeping the income constant ($P<0.01$) and widening the inequality further.

Table 21: Measures for Association of Savings by Income Groups Before and After Increment in the Price of Food Basket by 10%

	R	R Squared	Eta	Eta Squared
Total savings before * Income Group	-0.712	0.507	0.794	0.631
Total savings after * Income Group	-0.710	0.505	0.794	0.630

Table 21 shows the value of R^2 for estimates of the model testing the association of savings by income groups before and after the increment in the price of food basket by 10%, which was 34% in each of the cases. These values of R^2 mean that the income strata explain the variation in the change in savings in case of any increment in food expenditure sufficiently.

Further, the proportion of saving to the income of households significantly increased, moving from poor to wealthy households, widening the inequality of saving a proportion of income further between poor and rich households, making the rich the richer and the poor the poorer.

5. Discussion and Conclusion

The study utilized the real time data-set to analyze the income distribution across different groups of households and changes in the food consumption behavior of the households. The value of Gini-Coefficient, a measure of income inequality distribution, was derived as 0.371, i.e. 37.1 out of 100 scales, leading to higher income disparity in general (Indexmundi, 2019). Thus, the gap between rich and poor remains a challenging issue. The Gini-Coefficient might have significantly increased in the current Covid-19 context as the five years after large outbreaks saw a 1.5 points increase in the Gini index (World Bank, 2020).

Finding out if there have been major changes in the population's food consumption patterns across different socioeconomic categories is crucial since it has significant policy implications. The study's findings demonstrate a structural change in how households in various income brackets consume food. When the household food expenditure increased in nominal terms at a rate of 10% in general, this proportion to income decreased with an increase in the income of households, moving from lower to higher income strata. It is expected that households will switch their spending priorities from necessities like food to pleasures like non-food goods as their income rises over time. Similarly, one-fifth of wealthy households hold the largest income share (half of the total income), but poor households share a higher food budget proportion than wealthy households.

As the per household income increases, the portion of the food budget decreases in the household economy according to Engel's law. By increasing the price of food basket by 10% and keeping the income constant, Engel's coefficient was calculated again to conduct the Engel curve analyses, which displays the same findings as those made by Engel's law, which states that the ratio of food spending to income declines for higher income strata.

According to Engel's law, food had a lower projected expenditure elasticity of demand than non-food products (Clements & Si, 2018). Additionally, the expenditure elasticity of food for the high expenditure group was lower than it was for the low expenditure group in both the cases of before and after increment in the price of food basket by ten percent. The expenditure elasticity of

overall food items was higher for poor households compared to wealthy households. As a result, this research demonstrated that Engel's law might be applied to the domestic economy.

The fact that the R^2 values for estimates of the primary models are relatively high is one of this study's main advantages. High R^2 values imply that the study's independent variables adequately account for the variation in household food spending. Given that this study examined cross-sectional data, it is believed that each household's food costs are uniform. Relaxing this presumption would probably result in an even greater rise in R^2 levels.

In this study, the Gini-Coefficient was employed as a measure of the income distribution. However, because Gini-Coefficient is a measure of relative rather than absolute wealth, it should not be used to determine overall wealth or income (WPS, 2021). The data for the expenditure on food consumption was assumed to be increased by ten percent, whereas the income was considered to be constant in this study to compare the proportion of increment on the prior and subsequent food expenditure patterns of households upon ten percent increment in the price of the food basket. However, using the realistic data of inflation rate on food items (realistic increment in the price of food) and actual increment in the average income of households for the particular years may have offered more crucial details about shifting patterns of income and food expenditure. Further research may focus on overcoming these constraints.

The comparative findings on income distribution pattern evidenced by the *Lorenz curve* and *Gini-coefficient* in this study are important to devise effective pro-poor policies addressing the catastrophic economic burden on poor households as the poor households are hit significantly more by the increased price of commodities and services than that of the wealthy households. The comparative findings on disproportionate food expenditure patterns across different income groups evidenced by the *Engel Coefficient* in this study are of utmost importance to develop sensible food regulations. Food is a basic necessity, and people devote a significant portion of their cash to it. Even more of the food budget is allocated to disadvantaged households.

Therefore, the country province needs to take down the *Gini-Cofficient* significantly. When creating tax policies, extra care must be used on the lower range of income and food, as the lower range of income earners are poor households while the majority of food taxes are paid by low-income households. Poor households consume relatively more of their income on basic food items. According to other studies, poor households only eat food that is richer in carbs and starches and less on healthy diets (Nsabimana *et al.*, 2020), consistent with the findings in this study. This leads to a low investment of poor households in other significant facets of life, like education and health and therefore leads to further disparity in these indicators and results in the poor quality of life among these households. Therefore, the government has to launch pro-poor policies in the service sector, including in the education and health sector and should also make efforts to make all food commodities available to households in need and address the problems of food insecurity among poor households.

Some of the limitations of this research are as follows: (i) it is a cross-sectional study while a longitudinal study might be more relevant to draw plausible inferences; (ii) it consists of small sample size, and a large sample size might be more representative of a developing economy. We, therefore, recommend for longitudinal study with a larger sample size for future research.

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