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**PB Marviya**  
Department of Agricultural  
Statistics, College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

**SM Upadhyay**  
Department of Agricultural  
Statistics, College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

**MS Shitap**  
Department of Agricultural  
Statistics, College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

**AG Sabhaya**  
Department of Agricultural  
Statistics, College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

**PK Ukani**  
Department of Biochemistry,  
College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

#### Correspondence

**PB Marviya**  
Department of Agricultural  
Statistics, College of Agriculture,  
Junagadh Agricultural  
University, Junagadh, Gujarat,  
India

## Estimation of adult equivalent scale for consumption expenditure of food and non-food items in rural and urban sectors of south saurashtra agro-climatic zone

**PB Marviya, SM Upadhyay, MS Shitap, AG Sabhaya and PK Ukani**

#### Abstract

The objective of the study was to find out the relationship between per capita specific commodity expenditure and per capita total expenditure for food and non-food items in rural and urban area of Junagadh district of Gujarat state. Junagadh district was selected purposively for the study as it was an unexplored area in such type of study. Data regarding family budget were collected by conventional survey method with the help of pre-structured questionnaires and personal interview of the head of the sample households during 2015-16 (Agricultural year) for three different seasons viz., winter (W), summer (S) and monsoon (M). The effect of household composition has been taken into account after developing the consumer unit scales. The maximum value of adult equivalent scale was obtained for 20-40 years female and adolescent sex groups in rural households, implying that both the sex groups shared the highest proportion of total household expenditure. Similar trend was found for urban and overall. The average per capita monthly total expenditure in urban areas was found to be more than that of rural area during different seasons.

**Keywords:** AES, Regression analysis, Consumption Expenditure, Food and non food items

#### 1. Introduction

India's faster economic growth over 20<sup>th</sup> century has raised per capita income (expenditure) and has significantly changed the food consumption patterns by causing a change in the structure of food consumption patterns that observed earlier during pre-reforms period. The households in rural and urban areas make expenditure on different commodities to attain utility and satisfaction. The expenditure on food commodities and items are most important in the household behavior as food is basic nutritional ingredient for every human being. Therefore, in the analysis of consumer behavior, the food consumption is said to be the expenditure made by the consumer on different food commodities to meet the daily food needs.

Adult equivalent scale (AES) is used primarily in household consumption analysis because they are more meaningful than the indiscriminate 'per-capita' consumption. The needs of a household grow with each additional member but it is not in a proportional way due to economies of scale in consumption.

The term adult equivalent scale or consumer unit was given by Farrel in 1952 [2]. This approach permits to be dealt with the same footing. Consumer AES has been estimated by using different methods viz., ordinary least square technique, method of iterative procedure and method of weighted least squares technique by various research workers. The ordinary least square technique can be used for estimating the consumer AES for estimating per capita income/expenditure. The standardization of consumer unit can be done by using without intercept regression technique. This method was used by Bhuyan (1973) [1], Jain (1983) [3] and Shiyani and Singh (1996) [5].

The modified iterative procedure was used by Singh and Nagar (1973) [6] to obtain the estimate of equivalent weight for total expenditure. This modified approach was suggested for the type of study which involves data collection at the survey stage of consumption of at least one item individual member wise in the sample households. This approach was also used by Prais and Houthakker (1955) [4], Singh and Nagar (1978) [7] and Sing and Patel (1982) [8].

**Material and Methods**

The study was undertaken in Junagadh district of south Saurashtra agro-climatic zone as this area was an unexplored in such type of detailed study. Data were collected separately for rural and urban sectors. The choice of the district should be deliberated, in the sense that, depending on operational convenience, it will provide a suitable background in term of agro-economic feature for examining inter-class difference in consumer household for various commodity groups.

The selection of household was done by adopting a multistage random sampling design with tehsils (Talukas) in selected district as the first stage unit, town and villages within each tehsil as second stage units and households within selected

town and villages as the third stage units. Total 240 (120 each of rural and urban sectors) households were included in the study.

Primary data pertaining to the research study of food and non-food items including socio-economic characteristics, land holding, yield, income *etc.* were collected through personal interview method with the help of pre-tested comprehensive interview schedule by survey method. The reference period for the study was the agricultural year 2015-16.

As per the objective of the study, data were collected for the expenditure on food and non-food items (variables) as represented in Table 1.

**Table 1:** List of selected ‘food’ and ‘non-food’ items

Sr. No.	Variable	Items (30 days)	Sr. No.	Variable	Items (30 days)
1	X <sub>1</sub>	Liquid milk	8	X <sub>8</sub>	Oil & fats
2	X <sub>2</sub>	Ghee	9	X <sub>9</sub>	Spices
3	X <sub>3</sub>	Other milk product	10	X <sub>10</sub>	Vegetables
4	X <sub>4</sub>	Cereal	11	X <sub>11</sub>	Fish/ Egg/ Non veg.
5	X <sub>5</sub>	Pulses	12	X <sub>12</sub>	Beverage/ non beverage
6	X <sub>6</sub>	Sugar and Gur	13	X <sub>13</sub>	Non food item
7	X <sub>7</sub>	Fruit			

Total expenditure was used as the independent variable and specific main commodity groups expenditure as the dependent variable.

For further analysis, four new variables (main commodity groups) presented below in the Table 2 were also included.

**Table 2:** Generated new variables from the main commodity groups

Sr. No.	Variable	Main commodity groups	Sum of items
1	TM	Total expenditure on milk and milk product	X <sub>1</sub> +X <sub>2</sub> + X <sub>3</sub>
2	TF	Total expenditure on other food item (without milk and milk product)	X <sub>4</sub> +X <sub>5</sub> +X <sub>6</sub> +X <sub>7</sub> + X <sub>8</sub> + X <sub>9</sub> +X <sub>10</sub> + X <sub>11</sub> +X <sub>12</sub>
3	TNF	Total expenditure on all non-food item	X <sub>13</sub>
4	TOT	Total expenditure/total consumer expenditure	X <sub>1</sub> +X <sub>2</sub> + ..... + X <sub>13</sub>

Regression analysis technique without intercept was adopted for estimating the consumer equivalent adult scale for the three main groups as well as total expenditure.

$$X_j = b_1n_{1j} + b_2n_{2j} + b_3n_{3j} + b_4n_{4j} + b_5n_{5j} + b_6n_{6j} + \epsilon_j$$

$$Y_{ij} = b'_1n_{1j} + b'_2n_{2j} + b'_3n_{3j} + b'_4n_{4j} + b'_5n_{5j} + b'_6n_{6j} + \epsilon_j$$

Where,

X<sub>j</sub> = Total consumer expenditure of j<sup>th</sup> household

Y<sub>ij</sub> = Consumption/expenditure of i<sup>th</sup> commodity group in the j<sup>th</sup> household

n<sub>1j</sub> = Number of pre-school children (up to 4 year) in the j<sup>th</sup> household

n<sub>2j</sub> = Number of school going children (4-13 year) in the j<sup>th</sup> household

n<sub>3j</sub> = Number of family members in adolescent group

n<sub>4j</sub> = Number of male family members in 20-40 years age group

n<sub>5j</sub> = Number of female family members in 20-40 years age group

n<sub>6j</sub> = Number of adult family members in age group of above 40 years

ε<sub>j</sub> = Random disturbance term having zero mean and constant variances (0, σ<sup>2</sup>)

The parameter b<sub>1</sub>, b<sub>2</sub>, b<sub>3</sub>, b<sub>4</sub>, b<sub>5</sub> and b<sub>6</sub> was estimated by ordinary least square (OLS) technique for both the sectors and for all the seasons separately making total six set of estimate for each of main commodity groups. Similarly, b'<sub>1</sub>, b'<sub>2</sub>, b'<sub>3</sub>, b'<sub>4</sub>, b'<sub>5</sub> and b'<sub>6</sub> were estimated without intercept.

**Developing adult equivalent scale and standard household size**

The consumer unit was selected as adult of 40 years above. Thus, adult equivalent consumer unit scales were computed as shown in Table 3.

**Table 3:** Computation of adult equivalent scale

A	Pre-school children (up to 4 year)	$\hat{b}_1 / \hat{b}_6$
B	School children (4-13 years)	$\hat{b}_2 / \hat{b}_6$
C	Adolescent (13-20 years)	$\hat{b}_3 / \hat{b}_6$
D	20-40 years male	$\hat{b}_4 / \hat{b}_6$
E	20-40 years female	$\hat{b}_5 / \hat{b}_6$
F	above 40 years	$\hat{b}_6 / \hat{b}_6 = 1$

This consumer unit was estimated separately for main commodity groups viz. total expenditure on milk and milk products (TM), total expenditure on other food items (without milk and milk product) (TF), total expenditure on all non food items (TNF), total expenditure/total consumer expenditure (TOT) for three seasons within each of the two sectors.

The weighted household size was derived by using the consumer unit & was estimated as follows:

$$\sum_{g=1}^G w_{ig} n_{gi} = \frac{\hat{b}_1}{\hat{b}_6} n_{1j} + \frac{\hat{b}_2}{\hat{b}_6} n_{2j} + \frac{\hat{b}_3}{\hat{b}_6} n_{3j} + \frac{\hat{b}_4}{\hat{b}_6} n_{4j} + \frac{\hat{b}_5}{\hat{b}_6} n_{5j} + n_{6j}$$

and

$$\sum_{g=1}^G W_{og} n_{gj} = \frac{\hat{b}'_1}{\hat{b}'_6} n_{1j} + \frac{\hat{b}'_2}{\hat{b}'_6} n_{2j} + \frac{\hat{b}'_3}{\hat{b}'_6} n_{3j} + \frac{\hat{b}'_4}{\hat{b}'_6} n_{4j} + \frac{\hat{b}'_5}{\hat{b}'_6} n_{5j} + n_{6j}$$

$W_{ig}$  = Specific adult equivalent scale for  $i^{th}$  commodities group in the  $g^{th}$  age-sex group.

$W_{og}$  = Adult equivalent scale common to expenditure commodity group in  $g^{th}$  age-sex group

$n_{gj}$  = number of person in  $g^{th}$  age-sex group and  $j^{th}$  household.

Thus,

$$\sum_{g=1}^G W_{ig} n_{gj} = \text{Standard household size of } i^{th} \text{ commodity group}$$

in the  $j^{th}$  household

$$\sum_{g=1}^G W_{og} n_{gj} = \text{Standard household size of total expenditure}$$

for  $j^{th}$  household

Then,

$$\frac{Y_{ij}}{\sum_{g=1}^G W_{ig} n_{gj}} = \text{Per consumer unit (AES) expenditure on } i^{th} \text{ commodity group}$$

$$\frac{X_{ij}}{\sum_{g=1}^G W_{og} n_{gj}} = \text{Per consumer unit total expenditure for } j^{th} \text{ household}$$

### Results and Discussion

The AES was calculated for different age-sex groups for different seasons in rural and urban areas as well as for the overall of South Saurashtra agro-climatic zone as a whole are presented in Table 4, 5 and 6, respectively.

**Table 4:** Adult equivalent scale for different commodity expenditure groups in rural households during various seasons

Main commodity groups	Age sex groups (Rural)						Reg. coefficient associated with adult (C)	$\bar{R}^2$ (%)
	Pre-school children (up to 4 year)	School children (4-13 years)	Adolescent (13-20 years)	Male (20-40 years)	Female (20-40 years)	Adult (above 40 years)		
	(N1)	(N2)	(N3)	(N4)	(N5)	(N6)		
Winter								
TM	-0.169	0.954	1.011	1.156	1.186	1.000	617.01	82.23**
TF	0.043	0.720	0.812	0.784	1.222	1.000	994.64	89.85**
TNF	-0.549	0.683	1.146	1.033	1.663	1.000	1009.50	85.63**
TOT	-0.235	0.761	0.987	0.967	1.383	1.000	2621.15	92.90**
Summer								
TM	-0.638	1.047	1.223	0.837	1.677	1.000	1020.48	84.78**
TF	0.682	0.373	1.226	0.988	1.487	1.000	1629.34	88.56**
TNF	1.255	0.227	1.315	1.029	1.447	1.000	1091.38	84.84**
TOT	0.432	0.502	1.261	0.990	1.598	1.000	3631.53	89.91**
Monsoon								
TM	-0.286	-0.220	1.154	1.293	1.625	1.000	676.65	84.30**
TF	-0.602	0.306	0.931	0.907	1.448	1.000	1054.58	89.27**
TNF	1.129	0.148	1.360	1.152	1.699	1.000	981.65	84.31**
TOT	0.103	0.118	1.142	1.092	1.583	1.000	2712.88	93.22**

\*\* Significant at 1% level of significance

The estimates of adult equivalent scales for main commodity group for different seasons provided in Table 4 for rural households revealed that the females in age group of 20-40 years accounted for the maximum expenditure share in Total milk (TM) commodity group in all seasons similar results were obtained for other commodity groups *i.e.* TF, TNF and TOT for all seasons, This is justified on the ground that females are involved in almost all types of physical work (like

farming, dairying, homemade products etc.) in addition to household work. A perusal of Table 4 further revealed that the expenditure on total expenditure taken together, increased with the higher age group. Pre-school children group was found less expensive for all the commodities in different seasons except for TF in summer and TNF in summer and monsoon both.

**Table 5:** Adult equivalent scale for different commodity expenditure groups in urban households during various seasons

Main commodity groups	Age sex groups (Urban)						Reg. coefficient associated with adult (C)	$\bar{R}^2$ (%)
	Pre-school children (up to 4 year)	School children (4-13 years)	Adolescent (13-20 years)	Male (20-40 years)	Female (20-40 years)	Adult (above 40 years)		
	(N1)	(N2)	(N3)	(N4)	(N5)	(N6)		
Winter								
TM	0.385	0.599	1.009	0.797	1.461	1.000	635.73	85.46**
TF	0.080	0.377	0.840	1.185	1.113	1.000	1009.32	91.49**
TNF	-0.208	0.969	1.144	1.327	0.811	1.000	2805.98	84.61**
TOT	-0.058	0.782	1.056	1.219	0.973	1.000	4451.03	90.47**
Summer								

TM	0.247	0.986	0.418	1.584	0.769	1.000	494.70	74.41**
TF	0.677	0.707	0.598	1.498	0.575	1.000	912.01	82.89**
TNF	0.778	0.921	0.456	0.863	0.609	1.000	2062.35	84.47**
TOT	0.676	0.874	0.488	1.133	0.623	1.000	3469.05	87.22**
Monsoon								
TM	0.182	1.061	0.376	1.625	0.827	1.000	467.30	71.64**
TF	0.528	0.525	0.701	1.096	1.024	1.000	1041.39	93.58**
TNF	0.406	0.677	0.865	0.933	0.806	1.000	3455.18	86.35**
TOT	0.410	0.681	0.785	1.032	0.853	1.000	4963.81	90.38**

\*\* Significant at 1% level of significance

The results of urban sector presented in Table 5 revealed that the male in 20-40 years age group accounted for the highest proportionate share of expenditure in different seasons for all main commodity groups except for TM in winter season and TNF in summer season. The total expenditure of urban also

increased with the higher the age group as in urban area except in summer season. Pre-school children group was found less expensive for all the commodities in different seasons except for TF in summer & monsoon both and TNF in summer.

**Table 6:** Adult equivalent scale for different commodity expenditure groups in overall households during various seasons

Main commodity groups	Age sex groups (Overall)						Reg. coefficient associated with adult ( )	$\bar{R}^2$ (%)
	Pre-school children (up to 4 year)	School children (4-13 years)	Adolescent (13-20 years)	Male (20-40 years)	Female (20-40 years)	Adult (above 40 years)		
	(N1)	(N2)	(N3)	(N4)	(N5)	(N6)		
Winter								
TM	0.117	0.770	1.016	0.962	1.310	1.000	629.76	83.83**
TF	0.061	0.547	0.826	0.986	1.167	1.000	1002.01	90.56**
TNF	-0.300	0.895	1.143	1.253	1.041	1.000	1904.64	70.90**
TOT	-0.124	0.774	1.030	1.125	1.125	1.000	3536.40	85.65**
Summer								
TM	0.256	0.956	2.037	1.106	2.009	1.000	614.78	73.26**
TF	1.340	0.314	1.915	1.143	1.749	1.000	1060.61	79.56**
TNF	0.707	0.466	0.634	1.058	0.799	1.000	1664.54	81.95**
TOT	0.796	0.498	1.293	1.112	1.347	1.000	3297.48	87.20**
Monsoon								
TM	0.259	0.010	1.590	1.480	1.742	1.000	496.02	76.51**
TF	0.037	0.315	0.938	1.070	1.237	1.000	1027.84	90.96**
TNF	0.048	0.446	0.310	1.167	0.613	1.000	2639.28	72.88**
TOT	0.070	0.361	0.618	1.181	0.901	1.000	4163.11	87.12**

\*\* Significant at 1% level of significance

The adjusted coefficient of multiple determination ( $\bar{R}^2$ ) for TM, TF, TNF and TOT were found to vary between 82.23 and 93.22 per cent in different seasons for rural, 71.64 and 93.58 per cent for urban and 70.90 and 90.96 per cent for overall, respectively.

An examination of the regression coefficients associated with adult more than 40 years in rural area revealed that an additional amount of `2621.15 was spent on total expenditure (TOT) for an addition of adult member in the family whereas the additional amount spent for TM, TF and TNF were `617.01, `994.64, and `1009.50, respectively in winter season of rural area. The corresponding figures for urban sector and overall were `4451.03, `635.73, `1009.32, `2805.98 and `3536.40, `629.76, `1002.01 and `1904.64 for TOT, TM, TF and TNF, respectively, during winter season. (4, 5 and 6)

In rural sector, an additional amount of `3631.53 was spent for TOT for an addition of adult member in the family whereas the additional amount spent for TM, TF and TNF were `1020.48, `1629.34, and `1091.38, respectively, in summer season. The corresponding figures for urban sector and overall were `3469.05, `494.70, `912.01, `2062.35 and `3297.48, `614.78, `1060.61 and `1664.54, respectively, during summer season.

During monsoon season in rural area, an additional amount of `2712.88 were spent for TOT for an addition of adult member in the family whereas, the additional amount spent for TM,

TF and TNF were `676.65, `1054.58, and `981.65, respectively. The corresponding figures for the urban sector and overall were `4963.81, `467.30, `1041.31, `3455.18 and `4163.11, `496.02, `1027.84 and `2639.28, respectively, in monsoon season.

### Conclusion

A close examination of data revealed that taking an overall view, the maximum numerical value of adult equivalent scale was obtained for females (20-40 years) and adolescent (13-20 years) groups in rural households, implying that females shared the highest proportion of total household expenditure. Children below 4 years were least expensive in rural and urban area. Similar trend was also found for urban and overall households that they have minimum values were found for child bellowed 4 years old and maximum value for 20-40 years male group in urban area and 20-40 years female group in overall household, respectively. The average per capita monthly total expenditure in urban areas was found to be more than that of rural area during different seasons.

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