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**Prevalence and Determinants of
Overweight and Obesity
Among Adults in Pakistan**

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PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS

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ABSTRACT

The imbalance between energy gained and consumed contributes to weight gain and fat accumulation in the body. The Body Mass Index when equalled and increased above 25 kg/m² is classified as overweight and equalled and above 30 kg/m² as obesity. Overweight and obesity is a global problem carrying immense consequences on individuals' lives. In the context of Pakistan, which is facing double burden of malnutrition, carrying out a study on excess weight is of utmost importance. The present study ascertains the prevalence and possible causes of overweight and obesity among adult population using Pakistan Panel Household Survey for 2010. The results of the present research show there are 30percentoverweight adults in Pakistan. Furthermore, along with certain underlying demographic and social characteristics, the study identifies physical activity to be the significant determinant of excess weight. Being overweight also increases the number of other excess weight individuals in the family. Interestingly, poverty and most of the food consumption variables turn out to be insignificant risk factors for overweight and obesity. By adopting certain prevention strategies which focus on the promotion of physical activity can help in lessening its prevalence and negative impact on adults.

JEL Classification: I12, I15

Keywords: Overweight, Obesity, Physical Activity

1. INTRODUCTION

Malnutrition, either in the form of underweight or excess body weight, is associated with increased morbidity for human lives. Having excess body weight was once perceived as a phenomenon of industrialised world. However, lately it has also extended to the developing countries. This problem of excess weight is not only highly prevalent but has also increased more than three folds since the 1980s both in developed and developing countries [Branca, Nikogosian, and Lobstein (2007)]. Presently the developing economies of the world are not only facing the problem of underweight population but are also at risk of excess weight; contributing to the double burden of malnutrition [Schmidhuber and Shetty(2005)].

Excess weight over the normal can be in the form of overweight or more dangerously being obese. Imbalance between energy gained and exhausted results in abnormal fat accumulation in the tissues of human body and ultimately leads to obesity. In the literature, Body Mass Index [BMI] ≥ 25 kg/m² is defined as overweight and ≥ 30 kg/m² is defined as obesity [WHO(2000)]. Excess weight is common in both children and adults, but, adults are the most vulnerable group to excess weight and its health implications. Worldwide, the percentage of excess weight is 37 in men and 38 in women in 2013, while it is 24 percent for boys and 23 percent for girls [Ng, *et al.*(2014)].

The increased prevalence of excess weight is not the only concern for nations, rather inequalities in its prevalence among population groups is another concern. Research across the countries shows that various economic and non-economic factors are responsible for having more body weight than normal [Popkin, Kim, Rusev, Du and Zizza (2006), Butland, *et al.* (2007)]. Income inequality within a country leads to insufficient diet pattern in one group and high caloric fast food in another group. It leads to the prevalence of malnutrition in both forms among people. Apart from it, various other factors are responsible for excess weight; more prominent among them are sedentary lifestyle, physical activity, and dietary intake.

According to a global disease burden research, Pakistan is ranked 9th among 188 countries in carrying obese population, in terms of absolute numbers

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[Ng, *et al.* (2014)]. Recent figures for Pakistan suggest that 40 percent of Pakistani women of reproductive age are either overweight or obese [Pakistan Demographic and Health Survey (PDHS) (2012-13)]. Although Pakistan is still considered as an undernourished country in the context of children [National Nutrition Survey (NNS) (2011)] but given high proportion of overweight adults and limited consideration to subject matter, creates an alarming situation in the country. Additionally, its risk factors especially in adult age are important to target intervention related to its control and prevention that can reduce its long term negative impact.

2. THEORETICAL FOUNDATION AND REVIEW OF LITERATURE

Human behaviour is very complex and economics provides us with the basic tools to understand it. In what way a person behaves in achieving an ideal body weight along with keeping the desired utility level of consuming food and enjoying sedentariness, can be studied with the help of economics. For the said purpose, household production function theory in economic literature has proved to be a road map for studying it [Chou, Grossman and Saffer (2002); Cawley (2004); Rashad, Grossman, and Chou (2006); Mann (2008)].

Households not only consume goods and services but also produce certain more essential commodities using their time and market goods. Among these essential commodities produced by households, good nutrition is very important which ultimately leads to good health. Households produce their own nutrition and health to gain utility subject to time and resources constraints. Given limited time during a day and limited resources of income, individuals have to choose about what type of food to eat, how to distribute time between work and leisure, and how to invest in health etc. [Becker (1965)].

Hence utility function of the household can be constructed as:

$$U = U(N, H, F, C, L, O)$$

Where N stands for nutrition, H for health, F for food intake, C for non-food consumption, L for leisure, and O for other goods and services which increase the wellbeing of households. A household gains utility by achieving ideal body weight, but, at the same time they gain utility by eating. Because food is not only a biological need for human beings but also a source of pleasure. Therefore, excess weight is the consequence of achieving other aims [Chou, *et al.* (2002)]. A trade-off is to be made here between food consumption and achievement of healthy body weight. The determinants of nutritional status can be shown from the function below:

$$N = N(F, E, I, HH; \epsilon)$$

It expresses that nutritional status depends on food intake (F), energy consumed (E) through physical activity whether at work or during leisure time and other individual (I) and household (HH) characteristics [Cawley (2004)]. Now, it is individual decisions and circumstances that decide about a person's nutrition status. Due to this reason certain people are more vulnerable to being overweight and obese than others.

Different factors might be responsible for this differential in body weight among the population. These include demographic, socio-economic, food consumption, physical activity and hereditary factors. Age and gender are strong demographic predictors of overweight and obesity. Research shows that prevalence of obesity by age displays the U-shape trend i.e. obesity firstly increases with age and then it starts decreasing [Haslam, Sattar, and Lean (2006)]. Literature also shows that women are more prone to excess weight which might be due to lack of physical activity being confined at homes [Khan, *et al.* (2008)]. Like several other health issues, excess weight is also linked with being married [Janghorbani, *et al.* (2008)]. Similarly, social and cultural environment of a residing area is an important predictor of excess weight due to the diversity of lifestyles. For instance urban areas have more comforts and facilities than rural areas making space for a sedentary and inactive routine [Dennis, *et al.* (2006); Ahmed, Laghari, Naseer and Mehraj (2013)].

Studies in developing countries like Pakistan provided evidence that individuals belonging to well-off households are heavier than poor families [Mushtaq, *et al.* (2011)]. The reason can be the changing lifestyle of the affluent class in terms of eating fast foods, easy mode of transportation in cars and reduced physical activity at home due to nonstop television and access to social media. However, literature from the developed countries of the world portrays a contrary concept of poverty and obesity. According to the work on industrialised countries, obesity occurs through eating low cost junk food containing high calories and poor nutrients [Drewnowski and Darmon (2005)]. Similarly, education is viewed as a high socio-economic status in society, which leads to luxurious and sedentary lifestyle which is an immediate contributor to obesity [Devaux, Sassi, Church, Cecchini, and Borgonovi (2011)].

Along with these accompanying characteristics, the most immediate causes of overweight and obesity are food intake and the intensity of physical activity in daily routine life [Popkin, *et al.* (2006)]. Popkin, *et al.* (2006) claim that individuals consuming high caloric diet compared with low caloric consumption are more at risk of being overweight and obese. Moreover, fast food intensifies the fat and caloric intake which is unhealthy for the body. A study shows that an increase in the trend of eating in restaurants leads to the increase in BMI [Rashad, *et al.* (2006)]. Khan, *et al.* (2008) stated that obese subjects in their study were leading sedentary lives with little physical activity. As eating habits for both obese and non-obese subjects were similar it can be seen that there is no association of food intake with obesity. This shows the critical importance of physical activity

in relation to dietary patterns. This energy imbalance created by excess energy intake and less energy utilisation leads to excess weight [Bleich, Cutler, Murray, and Adams (2007)].

Genetics also plays an important role in determining overweight and obesity as shown by various studies. According to a study children are more likely to be obese if any one of their parents is obese [Whitaker, Wright, Pepe, Seidel, and Dietz (1997)]. While contradictory results against hereditary factors are also reported in some of the studies. Antonanzas and Rodriguez (2010) believe that genetic factors do not play much role in obesity and contribute only 1 percent in it. A few studies have noted that the environment of the home and family lifestyle are play a greater role in weight gain than genetics [Crowle and Turner (2010)].

Certain other factors are also associated with overweight and obesity in worldwide literature including ethnicity [Booth, *et al.*(2001)], pregnancy and high parity [Heliovaara and Aromaa (1981)], childhood obesity [Whitaker, *et al.*(1997)], breastfeeding behaviour [Kries, *et al.*(1999)], parental smoking [Leary, *et al.*(2006) or more specifically maternal smoking during pregnancy [Kries, Toschke, Koletzko and Slikker (2002)] and sleep duration [Vorona, *et al.*(2005)] etc.

3. DATA AND METHODOLOGY

For the attainment of the study's objectives, data from Pakistan Panel Household Survey (PPHS) has been used. It was conducted by Pakistan Institute of Development Economics in 2010. The dataset contains nutritional information i.e. weight and height measured for both sexes and for every age group. The centre of interest in the present study are adults of age 18 years and above. The reason for using adults is that they are more susceptible to excess weight and its related co-morbidities [Haslam, *et al.* (2006); Janssen (2012)]. Out of a total 29744 individuals surveyed, 16819 individuals were of age 18 years and above. The profile of these adults is given in appendix Table 1A. For estimating the prevalence of overweight and obesity among adults, the most frequent adopted measure in the literature i.e. Body Mass Index has been used. It is defined as weight in kilograms divided by the square of the height in metres.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

BMI scores, yielded from the formula classified in WHO defined categories are: BMI < 18.5 is classified as underweight; between 18.5 to 24.9 is regarded as healthy weight; ≥ 25 is classified as overweight and ≥ 30 as obese, which is further subdivided into 3 classes according to the severity of obesity [WHO (2000)].

These BMI cut-offs are internationally accepted, although it is believed that certain factors are responsible for higher body fat of Asians as compared to Europeans. That is why a lower BMI cut-off is used for Asian population i.e. 23-24.9 kg/m² for overweight and >25 kg/m² for obesity [WHO expert consultation (2004)]. For comparing the estimates with worldwide literature, a few studies on Pakistan and its nationally representative surveys, use international cut-offs [Dennis, *et al.*(2006); NNS (2011); PDHS (2012-13)]. Moreover, Asian cut-offs provide higher estimates compared to the current. As the present study is also using a nationally representative survey data, therefore the intention is to use international cut-offs.

Despite the worldwide acceptance and its computational ease, BMI also holds certain limitations [WHO (1995)]. Critics argue that it does not differentiate between lean body mass and body fat, hence it cannot be applied to persons with athletic built. In addition, it does not tell about the distribution of body fat in different parts of the human body which is more appropriate to detect morbidity due to obesity.

For working out the differentials and contributing factors for excess weight in adults, relevant socioeconomic, demographic and behavioural information is obtained from the dataset. Demographic variables include age, gender and marital status of the adult. Socio-economic factors incorporated in the study are education, poverty status, type and place of residence. The physical activity and food consumption of the adult can be incorporated as the behavioural factors. Due to lack of particular data, physical activity can be measured indirectly using variables like work status, type of work, availability of transport facility, availability of entertainment and availability of labour saving techniques¹.

Two Indicators are taken for measuring food consumption pattern. The first indicator is the number of times household members have eaten out at a restaurant. The second indicator includes consumption of the following items by a household during the last week: grains, pulses, oil, sugar, dairy products,² eggs, meat, vegetables and fruits, and soft drinks. For vicariate analysis, the quantity of consumption for each food item is divided into two groups; consumption below the median and consumption above the median.³ For multivariate analysis, their consumption is taken in continuous form. Due to lack of individual level data these variables are taken at household level which is also helpful because mostly household members share the same eating habits [Crowle and Turner (2010)].

Direct information about hereditary factor which is another important contributing factor in over-weight and obesity, is missing from the data. For

¹Transport facility includes availability of car or motorcycle at home; Entertainment includes television, computer/laptop or internet connection; and Domestic labour saving techniques includes washing machine, refrigerator, cooking range or microwave oven.

²Dairy Products includes: milk, yoghurt, lassi, cheese and butter.

³Median value is included in below median category.

capturing this input, a variable is constructed having a number of overweight and obese individuals in a household exempting the overweight and obese individual itself.

Both vicariate and multivariate analyses are performed for studying the determinants. For the purpose of multivariate analysis, binary logistic regression is performed for which the dependent variable, that is the individual's BMI is converted into dichotomous variable i.e. BMI<25 and BMI>=>25; where BMI =>25 which is classified as excess weight by WHO. The model equation for multivariate analysis is given as:

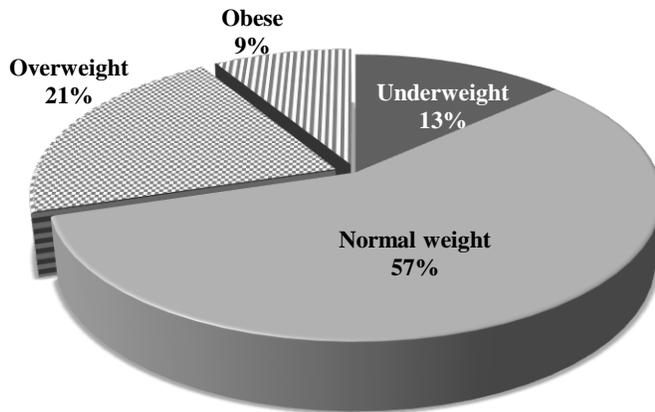
$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

Where Y is the dependent variable BMI; β s are the co-efficients; k is the number of independent variables and X s are the relevant independent variables identified from the literature.

4. PREVALENCE OF OVERWEIGHT AND OBESITY

The study shows the prevalence of overweight adults in Pakistan is 21 percent while that of obesity is 9 percent, that is we have 30 percent of our adult population is excess weight index (Figure 1). These results show a high prevalence of overweight and obesity in Pakistan which is a crucial finding of the present study.

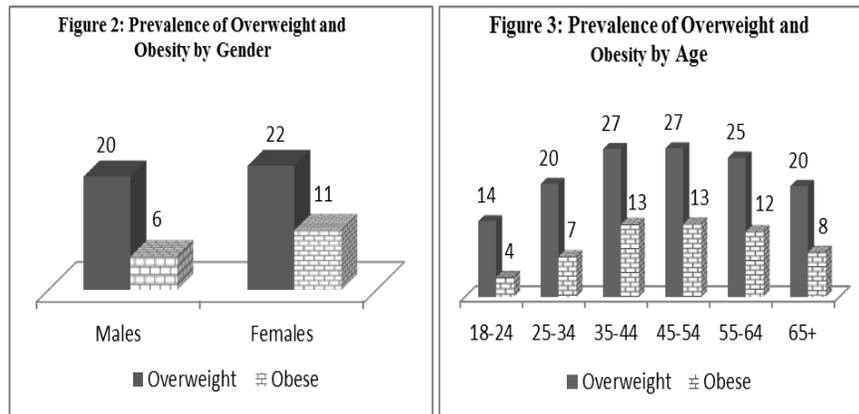
Fig. 1. Classification of Body Mass Index among Adults



Source: Authors' Computation from PPHS dataset, 2010.

5. DETERMINANTS OF OVERWEIGHT AND OBESITY

Results show a strong association between gender and excess weight. A higher proportion of females have excess weight i.e. 32 percent as compared to 26 percent of males (Figure 2). Similar findings in literature show that women gain more weight compared to men [Dennis, *et al.* (2006)]. Women 7410 might be more susceptible to weight gain because of lesser physical activity remaining confined to homes, as men go out to make a living.

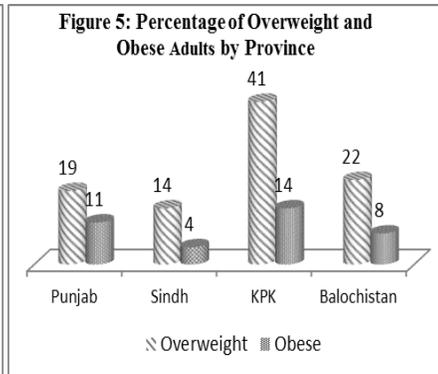
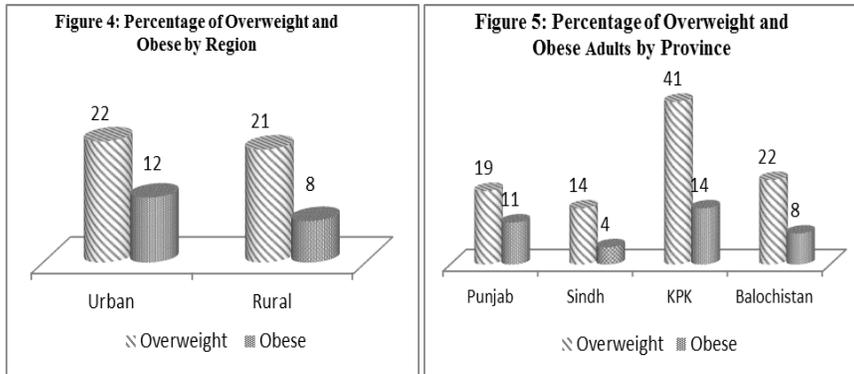


Source: Authors' Computation from PPHS dataset, 2010.

Age-wise results indicate that excess weight is highly prevalent among middle aged adults. It is lower in early adulthood, rising from that stage to 40 percent between the ages 35 to 54 and then declining at the elderly stage group to depict a U shape trend (Figure 3). Similar trend can be seen in another study by Dennis *et al* in 2006, where weight increase occurs up to 50 years before starting to decline.

In the present analysis, the type of residence is taken into account, region and province-wise. Regionally overweight and obesity is more dominant in urban areas compared to the rural. Figure 4 indicates excess weight adults at 34 percent in urban areas and 28 percent in rural areas. Findings of Dennis, *et al.* (2006) corroborate the present results. This is so because life styles are starkly different in urban and rural areas. The pattern and composition of food intake, means of transportation, and easy access to facilities leads to a sedentary lifestyle discouraging physical activity that leads to increased weight in urban areas [Sherin (2013)].

Beside regional differences, provinces too have their own characteristics according to their socioeconomic and cultural norms leading to nutritional differences.

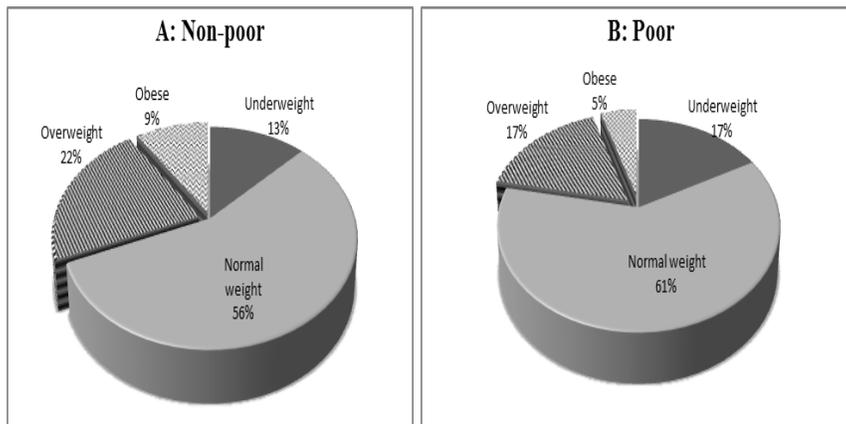


Source: Authors' Computation from PPHS dataset, 2010.

Khyber Pakhtunkhwa (KPK) has the highest percentage of excess weight individuals i.e. 56 percent followed by Punjab and Balochistan where there is 29 percent occurrence of excess weight. Obesity is more prevalent in Punjab than overweight which is higher in Balochistan. Sind has the lowest prevalence of excess weight i.e. 19 percent compared to other provinces (Figure 5).

The wealth status of individuals shows contradictory results in literature. According to some researchers the poor are more prone to obesity due to consumption of unhealthy low cost food [Darmon, Briend, and Drewnowski (2003); Drewnowski and Darmon (2005)]. Other studies argue that high socioeconomic status brings ease and access to high caloric food that combined to a sedentary lifestyle leads to weight gain [Pampel, Denney, and Krueger (2012)].

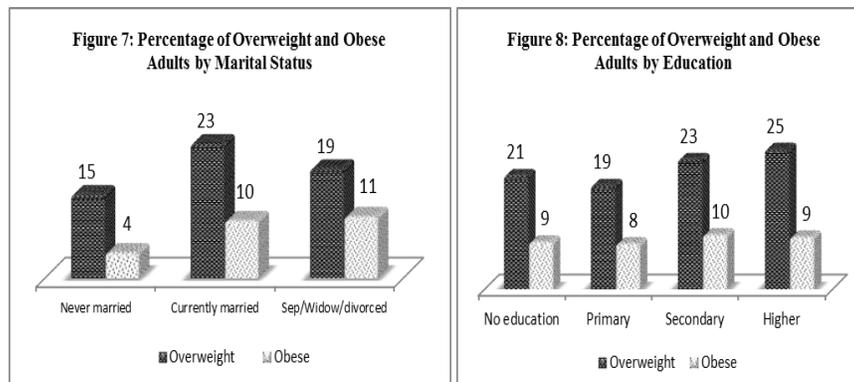
Figure 6: Percentage of Overweight and Obesity by Wealth Status



Source: Authors' Computation from PPHS dataset, 2010.

The present results are consistent with studies that favour the notion of higher obesity among the rich. According to their data the percentage of the overweight and the obese is 22 and 9 in rich or middle income groups compared to 17 and 5 percent among the poor (Figure 6).

Further analysis puts currently married adults at 23 and 10 percent overweight and obese respectively. Following them are those once married having 19 and 11 percentages for overweight and obesity (Figure 7). The lowest percentage of overweight and obese is among then ever married category i.e. 15 and 4 percent respectively.



Source: Authors' Computation from PPHS dataset, 2010.

There are similar findings in literature of higher weight among the currently or formally married than unmarried persons. The reason can be a change in dietary habits or physical activity, attaching lesser importance to physical appearance etc. after marriage, and child bearing in case of women [Janghorbani, *et al.* (2008)].

Higher education is an indicator of better socioeconomic position of an individual in society which increases the likelihood of being over-weight [Branca, *et al.* (2007)]. These results are shown in Figure 8 where 32 and 35 percent of the adults in secondary and higher education groups respectively have weight that is above normal. These percentages are 29 and 27 for no education and primary education categories respectively.

Work status and type of work are indicators of physical activity which are an immediate contributing factor to weight gain.

According to the results, highest percentage of overweight (32 percent) and obesity (13 percent) are among those who are in non-manual or desk jobs. Meanwhile, persons in manual jobs have low percent of overweight (19 percent) and obesity (6 percent) because of the labour intensive nature of their work (Table 1). Among those not working, housewives have the highest percent of overweight (25 percent) and obesity (13 percent), while students have the lowest rates i.e. 13 and 6 percent respectively.

Table 1

Percentage of Overweight and Obese by Work Status and Occupation

Work Status/Occupation	BMI Categories				Total
	Underweight	Normal Weight	Overweight	Obese	
Work Status					
Housewives	12.0	50.4	24.8	12.8	100
Students	21.5	60.2	12.8	5.5	100
Others not in labour force	15.2	62.0	17.5	5.2	100
Unemployed	17.4	58.9	15.8	7.9	100
Non-manual workers	4.5	50.4	32.2	12.9	100
Manual workers	13.8	61.6	18.6	5.9	100
Occupation					
Legislators/Senior officials/Managers	11.1	55.6	22.2	11.1	100
Professionals	7.1	50.3	29.0	13.5	100
Technicians/Associate professionals	0.7	55.3	32.6	11.3	100
Clerks	6.1	41.5	39.0	13.4	100
Service and sales workers	12.5	63.9	17.2	6.4	100
Skilled agriculture and fishery workers	11.7	64.7	18.0	5.6	100
Crafts and related trades workers	23.3	52.9	15.4	8.3	100
Plant and machine operators	6.0	57.8	28.9	7.3	100
Elementary occupations	14.9	60.8	19.0	5.2	100
Armed forces	3.0	51.5	30.3	15.2	100
Total	13.3	56.9	21.1	8.7	100

Chi-square value: 0.00.

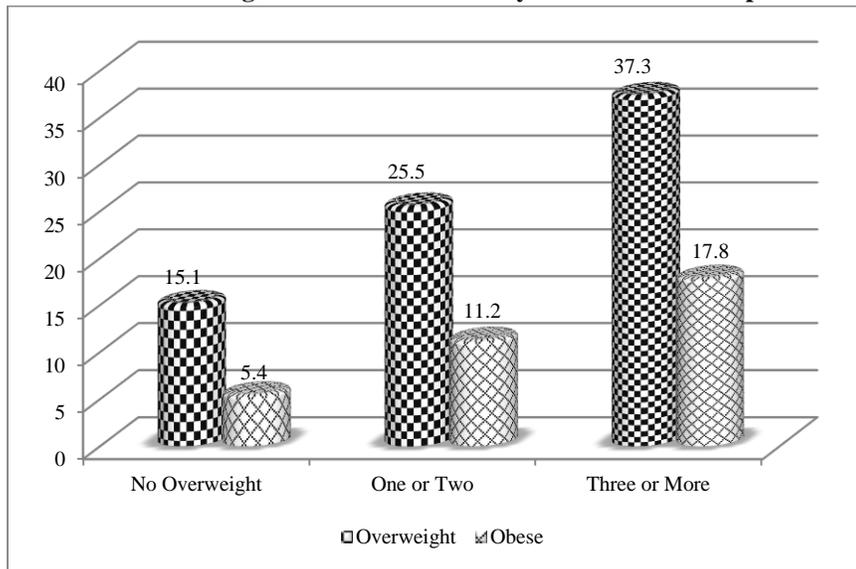
Note: Others no in the labour force includes elderly, unmarried women and men not working neither looking for work

Source: Authors' Computation from PPHS dataset, 2010.

The results are consistent with the present literature [King, *et al.* (2001)]. Housewives have limited physical activity while staying at home. Conversely, students being thoroughly engaged in studies might eat less and consume more through mental and physical exertion resulting in lower weight. Similar trend of higher rates of overweight and obesity for office or clerical work and lower rates for manual jobs can be seen in occupation wise analysis. For example, occupations like senior officials, managers, professionals and clerks have more percentage of excess weight. Occupations like sales workers, agriculture, machine operators and elementary occupations have lower rates (Table 1).

To check whether weight of other family members affects the likelihood of being overweight, the variable of familial obesity is constructed. Familial obesity is hence defined as the number of other overweight and obese individuals in the family.

Fig. 9. Percentage of Overweight and Obese Adults by Number of Overweight Persons in the Family other than the Respondent



Source: Authors' Computation from PPHS dataset, 2010.

Results show, the, higher the number of excess weight individuals in the family, the more is the chance of getting overweight and obese. For example, 21 percent of excess weight individuals have no other overweight and obese in the family. However, 37 percent of excess weight individuals have one to two other excess weight individuals in the family. More prominently, 55 percent of excess weight individuals have three or more other overweight and obese in the household (Figure 9). Similar results can be seen from the literature which associates it with mutual eating habits and family life style [Whitaker, *et al.* (1997); Crowle and Turner (2010)].

Table 2 indicates high occurrence of obesity i.e. 10 percent among those who have taken meals outside homes as compared to those that haven't i.e. 8 percent. The rationale behind it is that food outside homes can be more energy dense and caloric. Moreover, portion sizes and quantity of servings are large in restaurants compared to homes where one does not generally overeat. Similar trend is suggested by Rashad, *et al.* (2006). These results are also seen in accordance with both rural and urban areas separately (Table 2). It also shows similar results i.e. high obesity in those eating-out as compared to their counterparts. However, more prominent differential in obesity rates is seen between urban areas and rural areas. Results specify only 1 percent differential for rural and 9 percent for urban areas between both groups. Urban areas have more prominent differential in results because eating-out and hostelling is an urban phenomenon.

Table 2

Percentage of Overweight and Obese by Eating Out

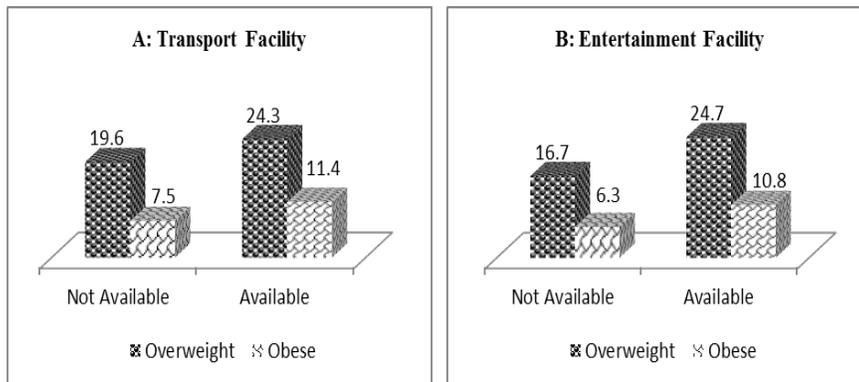
Meals Outside	BMI Categories				Total
	Underweight	Normal Weight	Overweight	Obese	
Total					
No	13.5	56.5	21.3	8.6	100
Yes	13.8	54.6	21.1	10.4	100
Urban					
No	12.1	54.2	22.1	11.6	100
Yes	6.3	49.8	23.7	20.3	100
Rural					
No	14.1	57.4	21.1	7.4	100
Yes	15.1	55.5	20.7	8.7	100

Chi-square values for Urban(0.00),Rural (0.29), and Total (0.14).

Source: Authors' Computation from PPHS dataset, 2010.

Availability of transport and entertainment facility in households indicates lack of adequate physical activity among its members [Andersen, Crespo, Bartlett, Cheskin, and Pratt (1998); Wen, Orr, Millett, and Rissel (2006)]. Results illustrate that 36 percent of adults with weight above normal are in households having availability of a means of transport (car or motor cycle) than 27 percent in households not having those facilities. Similarly, excess weight adults are 36 percent in households having an entertainment facility (television, computer/laptop, internet connection) than 23 percent in households not having those facilities (Figure 10).

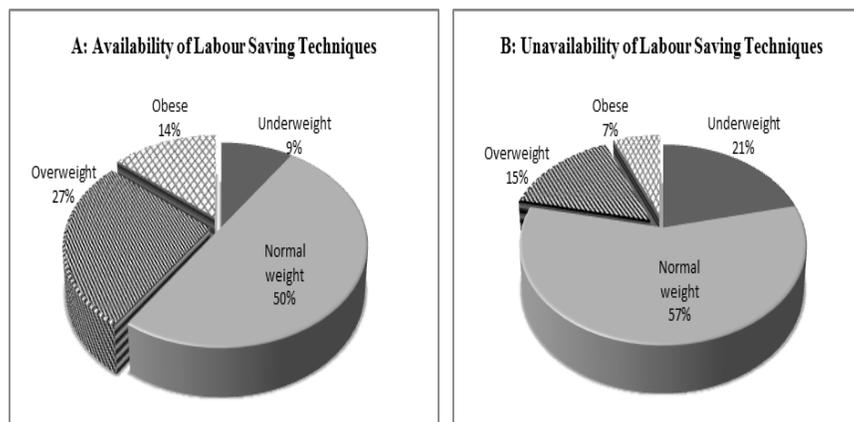
Fig. 10. Percentage of Overweight and Obesity by Transport and Entertainment Facility



Source: Authors' Computation from PPHS dataset, 2010.

The Households using electric appliances like refrigerator, microwave oven, cooking range and washing machine etc. are more prone to overweight and obesity. Percentages of overweight and obesity is 27 and 14 in households having electric appliances than 15 and 7 percent respectively in households without these appliances (Figure 11). Literature shows that owning electric appliances indicates reduced time and labour on domestic chores, leading to reduced physical activity and weight gain [Lanningham-Foster, *et al.*(2003)].

Fig. 11. Percentage of Overweight and Obesity by Domestic Labour Saving Techniques Facility



Source: Authors' Computation from PPHS dataset, 2010.

Food consumption is another immediate contributing factor of weight gain along with physical activity. If the diet composition is made up of food items comprising more fats and sugar, it contributes to increased weight gain [Guo, Warden, Paeratakul, and Bray (2004); Branca, *et al.* (2007)]. According to results households that consume above median quantity of oil, dairy products, eggs, meat, and soft drinks have high frequency of excess weight members. Comparatively, households consuming above median quantity of nutritious diet like grains and pulses have less proportion of excess weight individuals (Table 3).

Conflicting results are seen in families consuming fruit and vegetables yet having more excess weight individuals. This might be due to the reason that only rich people, who are more prone to overweight and obesity (as indicated by previous results), can afford to consume more fruits. Similarly, another opposing result comes from sugar consumption i.e. high consumption of sugar households have less excess weight individuals (Table 3). This can be linked to the fact that poor people consume more sugar compared to rich class which has access to more costly alternatives to sugar.

Table 3

Percentage having Excess Weight by Food Consumption

Food Items/ Consumption	Below Median Consumption	Above Median Consumption
Grains	29.8	29.9
Pulses	30.0	29.7
Oil	26.3	33.5
Sugar	31.4	28.4
Dairy Products	25.0	34.7
Eggs	25.8	34.6
Meat	26.6	33.1
Vegetables and Fruits	24.7	35.2
Soft Drinks	27.9	33.5

Source: Authors' Computation from PPHS dataset, 2010.

Note: Excess weight includes both overweight and obese.

Median value is included in below median consumption category.

Chi square values: Grains (0.82), Pulses (0.31), Oil (0.00), Sugar (0.01), Dairy products (0.00), Eggs (0.00), Meat (0.00), Vegetables and fruits (), and Soft drinks (0.00).

6. MULTIVARIATE REGRESSION RESULTS

For finding out the most significant contributing factors for excess weight, binary logistic regression is run. The dependent variable here is converted into two categories i.e. BMI < 25 given value 0 and BMI >= 25 given value 1. The results in Table 4 present the beta coefficients, value of significance, odd ratios and other model fitness values. Odd ratios are used to interpret categorical variables while the continuous variables are interpreted using beta coefficients. The sign of beta coefficients shows positive or negative relationship between the variables. Odd ratios express the likelihood of being overweight and obese across every explanatory variable keeping all other factors constant. Apart from a very few factors, the trend shown in multivariate analysis is consistent with bivariate analysis for almost all the factors.

Findings suggest that the likelihood of being overweight and obese increases with increase in age, education and number of other excess weight individuals in the household (Table 4). Beta coefficient results show 0.02, 0.04 and 0.38 unit increase in BMI with the increase in age, education and number of other oversized individuals respectively.

Table 4

*Result of Binary Logistic Regression for Determinants of
Overweight and Obesity*

Explanatory Variables	B Coefficient	Significance Value	Odd Ratio
<i>Age (in Single Years)</i>	0.015*	0.00	1.015
Female adults ¹	0.264*	0.00	1.302
Province – Sindh ²	-0.464*	0.00	0.629
Province – KPK	0.774*	0.00	2.169
Province – Balochistan	-0.042	0.65	0.959
Rural residents ³	-0.246*	0.00	0.782
Poor wealth status ⁴	-0.023	0.76	0.977
Currently married ⁵	0.750*	0.00	2.117
Separated/Divorced/Widowed	0.330*	0.02	1.391
<i>Education (in single years)</i>	0.037*	0.00	1.037
Work status –Students ⁶	-1.056*	0.00	0.348
Work status – Other not in labour force	-0.401*	0.00	0.670
Work status –Unemployed	-0.272	0.11	0.762
Work status –Non-manual workers	-0.041	0.77	0.960
Work status – Manual workers	-0.125	0.11	0.882
Car availability ⁷	0.232*	0.02	1.261
Motorcycle availability ⁸	0.037	0.52	1.038
Entertainment availability ⁹	0.000	1.00	1.000
Labour saving techniques availability ¹⁰	0.264*	0.00	1.302
<i>Number of meals eaten-out</i>	-0.002	0.77	0.998
<i>Consumption of Grains (in kg)</i>	-0.008	0.36	0.992
<i>Consumption of Pulses (in kg)</i>	-0.014	0.94	0.987
<i>Consumption of Oil (in litres)</i>	0.482*	0.00	1.619
<i>Consumption of Dairy Products (in litres)</i>	0.007	0.51	1.007
<i>Consumption of Meat (in kg)</i>	-0.115	0.23	0.891
<i>Consumption of Eggs (in numbers)</i>	0.065*	0.01	1.067
<i>Consumption of Soft Drinks (in numbers)</i>	0.092	0.11	1.096
<i>Consumption of Sugar (in kg)</i>	-0.025	0.73	0.975
<i>Consumption of Vegetables and Fruits (in kg)</i>	0.093*	0.01	1.097
<i>Other overweight family members (numbers)</i>	0.381*	0.00	1.463
Constant	-2.657*	0.00	0.070
Model Chi-square		1545.941	
Model Significance		0.00	
Log likelihood		10340.536	
Cox and Snell R ²		0.147	
Nagelkerke R ²		0.208	
Predicted Percentage		73.4	

Source: Authors' Computation from PPHS dataset, 2010.

Reference Categories: ¹Male adults, ²Adults in Punjab province, ³Urban residents, ⁴Adults of non-poor wealth status, ⁵Adults who are never married, ⁶Housewives, ⁷Individuals of households not owning a car, ⁸ Individuals of households not owning a motorcycle, ⁹ Individuals of households not owning an entertainment facility, ¹⁰Individuals of households not owning any labour saving techniques.

*Indicates significance of a variable; Variables in Continuous form are in *Italics*.

The results also show that females are 1.3 times more likely to be overweight and obese as compared to males. Among provinces, data assigns KPK as the province having highest proportion of excess weight individuals i.e. the likelihood of individuals being 2.2 times more overweight and obese in KPK than in Punjab. The other two provinces have a lower likelihood of overweight and obesity as compared to Punjab. Similarly, adults living in rural areas are 0.8 times less likely to weight gain than the urban residents.

Results regarding association between wealth status and weight shows less weight i.e. 0.97 times less, for poor people than the non-poor. For marital status, currently married adults have highest (2.1 times) likelihood of being overweight followed by ever married adults (1.4 times) as compared to the category of never married individuals (Table 4). The work status of the individuals indicates that housewives have the highest likelihood of being overweight and obese. Moreover, adults having the availability of car, motorcycle, entertainment facilities and labour saving devices have 1.26, 1.04, 1.0, and 1.3 times greater probability of weight gain respectively than those deprived of these facilities.

The results for meals taken outside home are inconsistent with the bivariate results (Table 4). Here, the results display a decrease in weight with the increase in number of meals taken outside homes. However, these results are not significant. According to the findings regarding consumption of different food items, BMI decreases by 0.01, 0.01, 0.12, and 0.03 points with one kg increase in grains, pulses, meat and sugar respectively. Conversely, with the increase in the consumption of one unit (litre, number and kg) of oil, dairy products, eggs, soft drinks, vegetables and fruits, BMI will also increase by 0.48, 0.01, 0.07, 0.09 and 0.09 points correspondingly. Nevertheless, food consumption results are significant only for oil, eggs and vegetables and fruits. The rest of the food consumption variables are insignificant.

Significant results for multivariate analysis show that the most significant contributing factors for overweight and obesity are age, gender, province, region, marital status, education, work status, car availability, labour saving devices, consumption of oil, eggs, vegetables and fruits, and familial obesity (Table 4). On the other hand, insignificant factors include poverty, availability of motorcycle and entertainment facility, eating out, and consumption of grains, pulses, dairy products, meat, sugar and soft drinks. Additionally, the p-value of 0.00 for the significant model shows that the overall model is statistically significant. The explanatory variables chosen for the model predict 73 percent of variation in the dependent variable, that is overweight and obesity.

7. CONCLUSIONS

After afflicting the developed world, overweight and obesity is now on the increase in developing countries also. Its increased prevalence and continuous rise, has become the present concern of nations. The evidence suggests that

Pakistan is among those nations having high prevalence of excess weight. The findings of the present study yield 21 and 9 percent prevalence of overweight and obesity respectively in Pakistani adults.

Literature shows that various socio-economic characteristics and sedentary lifestyle is responsible for overweight and obesity. The results show high prevalence of excess weight in middle age adults, females, in province KPK, among urban residents, married, educated, and rich adults, in non-manual workers and housewives, and among those eating meals outside homes. It is also found high in those having other excess weight family members, having availability of different time and energy saving devices and among those taking fatty diet. Along with certain demographic and social characteristics, results of multivariate analysis reveal physical activity variables to be the significant determinants of excess weight instead of food consumption variables. This highlights the importance of energy balance in terms of spending more energy than consuming. Familial obesity is also a significant factor for excess weight which draws attention to the mutual eating habits and life style of the family. Interestingly, poverty turns out to be an insignificant factor.

The study provides a comprehensive understanding of the pandemic of overweight and obesity amongst adults in Pakistan. It gives evidence of high prevalence of overweight and obesity; however, strategies to overcome it are not incorporated in the health plans of the country. In this backdrop, there is a need for policies and interventions for tackling this issue. Policies should not only focus on the obese individuals to control excess weight rather prevention strategies should also be made for those at risk of being overweight and obese. The most vulnerable group should be targeted for intervention prior to the rest of the population. Policy makers should target families instead of individuals for their intervention. Lack of physical activity came out to be the most significant cause of weight gain in the present research. To overcome it, adoption of active lifestyle should be advocated. Instead of using transport facilities for short distances, walking should be promoted. Advocacy should be directed at importance of exercise in daily routine especially if one is involved in a physical inactive occupation. Adoption of the strategies to overcome excess weight can aid in reducing its negative implications and attaining a sustainable health care sector.

Appendix

Table 1A

Basic Characteristics of the Sampled Population

Background Characteristics		Frequency	Percentage	
Population	Children <18	12925	43.5	
	Adults =>18	16819	56.5	
Gender	Male	8788	52.3	
	Female	8031	47.7	
Region	Urban	4824	28.7	
	Rural	11995	71.3	
Province	Punjab	6816	40.5	
	Sind	4974	29.6	
	Khyber Pakhtunkhaw	3119	18.5	
	Balochistan	1910	11.4	
Age	18-24	4641	27.6	
	25-34	4508	26.8	
	35-44	2831	16.8	
	45-54	2074	12.3	
	55-64	1437	8.5	
Education	65+	1328	7.9	
	No education	9315	56.7	
	Primary	2047	12.4	
	Secondary	3166	19.3	
	Higher	1914	11.6	
Marital Status	Never married	4846	28.8	
	Currently married	10804	64.2	
	Separated/widowed/divorced	1167	6.9	
Poverty	Non poor	13545	81.7	
	Poor	3044	18.3	
Work Status	Housewives	4828	29.4	
	Students	791	4.8	
	Persons not in the labour force	2113	12.9	
	Unemployed	422	2.6	
	Non-manual work	884	5.4	
Occupation	Manual work	7364	44.9	
	Legislators, senior officials and managers	27	0.3	
	Professionals	252	3	
	Technicians and associate professionals	247	3	
	Clerks	225	2.7	
	Service workers, shop and market sales workers	864	10.5	
	Skilled agriculture and fishery workers	2324	28.1	
	Crafts and related trades workers	690	8.3	
	Plant and machine operators and assemblers	487	5.9	
	Elementary occupations	3014	36.5	
	Armed forces	134	1.6	
	Transport Facility	Not available	11091	66.1
		Available	5691	33.9
Entertainment Facility	Not available	7116	42.4	
	Available	9664	57.6	
Domestic Labour Saving Devices	Not available	6982	41.7	
	Available	9773	58.3	
Eating-out	No	13169	85.7	
	Yes	2194	14.3	
Familial Obesity	Having no other obese in the family	7717	47.9	
	Having 1 to 2 other obese	7007	43.5	
	Having 3 or more obese	1396	8.7	
Food Consumption		Frequency	Mean	
	Consumption of Grains (<i>kg</i>)	16813	3.52	
	Consumption of Pulses (<i>kg</i>)	16809	0.15	
	Consumption of Oil (<i>kg</i>)	16805	0.27	
	Consumption of Dairy Products (<i>litre</i>)	16805	1.99	
	Consumption of Meat (<i>kg</i>)	16795	0.18	
	Consumption of Eggs (<i>numbers</i>)	16782	0.55	
	Consumption of Soft Drinks (<i>bottles</i>)	16782	0.12	
	Consumption of Sugar (<i>kg</i>)	16780	0.45	
	Consumption of Vegetables and Fruits (<i>kg</i>)	16801	0.87	
	Nutritional Status	Weight (<i>kg</i>)	11513	56.84
Height (<i>cm</i>)		11554	153.18	

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