

## An Analysis of Contributors to Energy Intake Among Middle Aged and Elderly Adults

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### ABSTRACT

Adulthood and middle age is widely recognized as the time of life when unhealthy eating habits may develop. Data from various studies have demonstrated that changes in eating habits may also occur during old age. It is essential to acknowledge that a high consumption of certain food groups such as sweetened beverages, meat and eggs may contribute to an increased energy intake. This obviously results in high body mass index (BMI) and consequently an increased risk of non-communicable diseases (NCDs) and obesity. Energy intake among middle aged and elderly individuals may be influenced by socio demographic factors (for example: age, gender, socio economic status), social factors (for example: marital status), environmental factors like access to food commodities as well as nutrition knowledge and physical activity level. The present review highlights eating habits, contribution of specific food groups to energy intake and the influence of several factors on energy intake among the middle aged and elderly population.

**Keywords:** Obesity, eating habits, socio economic status, middle age, elderly.

### INTRODUCTION

#### General eating habits

It is well documented that middle age is the most productive period of life in terms of work capacity but is also the time when unhealthy eating habits and sedentary lifestyles may develop, resulting in malnutrition and increased risk of chronic diseases<sup>1</sup>. Intake of fat, animal products and sugar is increasing while on the other hand, consumption of cereals, fruits and vegetables is decreasing across developing countries<sup>2</sup>. Similar results have been found among middle aged adults where a shift from cereals, pulses and potatoes to meat, fats, sugar, cheeses and desserts was noted<sup>3</sup>. Eating habits tend to vary between gender and across countries as well. For instance, middle aged individuals are found to consume rice, fish and vegetables on a nearly daily basis in Malaysia, with men consuming more vegetables than women<sup>4</sup>. However, in France, middle aged women have a higher consumption of fruits and

vegetables than men<sup>5</sup>. Men tend to consume red and processed meat more often than women while the latter consume skimmed milk and high fiber cereals in greater amounts<sup>6</sup>. It has been reported that food habits of middle aged individuals tend to differ from those of elderly people and that the latter skipped meals less often than middle aged adults<sup>4</sup>. With ageing, people tend to reduce the consumption of meat and certain dairy products but the intake of fish is likely to increase<sup>7</sup>.

Old age is accompanied by several transitions such as retirement which may impact on nutrition<sup>8,9</sup>. Physiological changes which reduce hunger in the elderly may result in decreased energy intake<sup>10</sup>. This finding is supported from a study in USA where older adults were found to have low energy intakes<sup>11</sup>. Generally, older adults tend to be less active and hence, there is a need to diminish energy intake due to a decrease in Basal Metabolic Rate (BMR)<sup>12</sup> but some believe they do not need

to adjust the quantity of food intake as they are already eating properly<sup>13</sup>. This can result in obesity as reported in the US where the percentage of obesity among the elderly has increased from 14.7 in 1991 to 22.9% in 2000<sup>14</sup>. A rise in obesity from 13 to 27% in elderly people has also been noted in China<sup>15</sup>.

During old age weight tends to decrease<sup>16</sup> while during middle age body weight increases<sup>17</sup>. The main reason is due to an energy imbalance whereby energy intake exceeds energy expenditure<sup>18</sup>. The energy requirements of middle aged men of 30-60 years who do moderate physical activity is 2761 kcal/ day while those of women in the same age range is 2225 kcal/day. Energy requirements are generally higher for middle aged than elderly people<sup>19</sup>. It has also been postulated that the reduction of energy dense foods combined with increases in fruit and seafood intakes can lead to a decline in Body Mass Index (BMI)<sup>20</sup>. This review paper aims to elaborate on some of the factors which can influence energy intake among adults and elderly individuals.

#### **Contribution of food groups to energy intake**

Recently, the emphasis has been on the study of different food groups which exist and their relationships with energy intake and hence, on the prevalence of overweight and obesity. Investigations are no longer restricted on individual nutrients or food groups since it has been recognized that food items are nearly always consumed in combination. The different food groups can be classified into: grains, proteins, dairy, fruits, vegetables and oils<sup>21</sup>.

In Teheran, a shift towards the western dietary pattern which includes the frequent consumption of processed foods, sweets and fatty food items is linked to an increased energy intake and hence, a high BMI<sup>22</sup>. It was also observed that a mixed dietary pattern which includes sweets, solid fats and meats as well as healthy items such as nuts, seeds and legumes does not lead to an increased BMI due to the possible interaction of the healthy components to compensate for the effect on obesity<sup>22</sup>.

Several studies reported the effects of different food groups on BMI and energy intake. The 1999-2004 National Health And Nutrition

Examination Survey (NHANES) during 1999 to 2004 demonstrated that a high consumption of whole grains such as rice, oats, and brown rice was inversely correlated with BMI and the prevalence of obesity<sup>23</sup>. Similar results were obtained in Canada where a high carbohydrate intake was linked to low energy intake<sup>24</sup>. The consumption of barley was found to enhance satiety and decrease energy intake more than whole grain wheat and refined rice in adults and especially among the elderly<sup>25</sup>. However, it has been suggested that the inverse relationship between high carbohydrate intake and low energy intake and BMI may not be related to lower total energy intake<sup>26</sup> but may be due to higher physical activity level<sup>27</sup>.

There have been some controversial findings as to whether non-vegetarian or vegetarian diet is linked to BMI. Meats, considered as being high in energy and fat may be linked to a higher prevalence of obesity<sup>28</sup>. Support for this claim comes from findings which indicate that high intakes of meat are associated with a high BMI and Waist Circumference (WC). In the same context, 'meat fat' (red meat, oil, poultry and processed meats) dietary pattern has a positive correlation with obesity in middle aged and elderly people whereas 'vegetables-seafood' (fish, soy foods, vegetables, fruits and sea weeds) dietary pattern are not linked to a high BMI and obesity<sup>29</sup>. Similar results are reported in the Adventist study where BMI gain are not found to be linked to vegetarian diets as compared to a non-vegetarian diet<sup>30</sup>. Following a vegetarian diet results in lower energy intake, higher fiber content and lower animal fats intake than non-vegetarian diet<sup>30, 31</sup>. BMI values are higher in non-vegetarians than their vegetarian counterparts in all age groups and for both men and women<sup>32</sup>.

On the other hand, no significant differences were reported in energy intake between vegetarians and non-vegetarians and the BMI of male vegetarians did not differ significantly from that of their non-vegetarian counterparts<sup>33</sup>. There is no evidence to suggest that one protein source is preferable than another but it has been advocated that animal proteins, especially dairy can support muscle protein synthesis better than plant proteins which can enhance energy expenditure<sup>34</sup>.

In the US, energy beverages such as soft drinks are on the rise and are replacing water and milk. Energy beverages largely contribute to high energy intake which then leads to weight gain<sup>35</sup>. In the US, one in four people get at least 200 calories from sugary drinks and individuals who increase their intake of sugary beverages by one 12-ounce serving per day gain much more weight than those who do not alter their consumption<sup>36</sup>. However, further research between sugar sweetened beverages and weight gain is required<sup>37</sup>. Alcohol is another beverage from which individuals can derive energy; in the U.S, the adult population consumes an average of 100 calories per day from alcoholic drinks, with the highest prevalence among men than women and younger adults aged 20-39 years than older ones<sup>38</sup>. About 527 kcal/day of energy was obtained from alcohol among Mexican adults<sup>39</sup>. High alcohol consumption is associated with poor dietary habits<sup>40</sup>. However, epidemiologic evidence does not show a clear cut relationship between alcohol intake and bodyweight and this complex association needs to be further studied<sup>41</sup>.

#### **Major factors influencing energy intake**

Besides the normal process of ageing and changes which accompany it such as sarcopenia, there are diverse factors which can influence energy intake of individuals<sup>42</sup>.

#### **Gender**

The biochemistry and physiology of women and men differ<sup>43</sup>. It has been reported that women, generally have lower energy intakes than men<sup>44</sup> due to the fact that women have a lower body mass and fat free mass but a higher % of body fat<sup>45</sup>. Females tend to choose more nutritious food items than males and have been found to be more concerned about health issues<sup>46, 47</sup>. De Silva *et al.* (2011) also attributed the gender differences in food consumption to stronger beliefs of women concerning healthy eating<sup>48</sup>. Moreover, women have better awareness and knowledge which may further contribute to healthy eating<sup>49</sup>. An alternative explanation may be that females are more likely to engage in weight control behaviors<sup>50</sup> and are more willing to compromise on taste to meet their weight related goals<sup>51</sup>. In addition, certain foods like red meat, alcohol and large portion sizes have been

associated with masculinity while vegetables, fruit and dairy products are linked to femininity<sup>43</sup>. However, some men do express some interest in nutrition and health and also advocate that they are trying to reduce red meat consumption and simultaneously, adding more vegetables to their diets<sup>43</sup>.

#### **Socio economic status (SES)/ Income level**

It is well known that socio economic factors have a strong influence on the diet and energy intake<sup>52</sup>. In general, people from higher socioeconomic groups are found to have a healthier dietary intake while poor people are more likely to become obese due to less healthy eating habits<sup>53</sup>. A study<sup>54</sup> in Mauritius also reported that the diet quality of women from medium and high SES had better diet quality than those of lower SES. The high energy intake of low income people has been attributed to the low cost of energy dense foods<sup>17, 55</sup>. Low-cost energy dense foods are both energy rich and shelf stable as compared to low energy dense diets which cost more<sup>56</sup>. Although it has been reported that low income people tend to become overweight, this may not always be true. For instance, chronic energy deficiency was found to be significantly higher among individuals of low socioeconomic status (SES) than those in high SES<sup>57</sup>. Across Mexico, a negative association between SES and obesity has been reported<sup>2</sup>. It has been suggested that an inverted U-shape relationship may exist between socio economic status and obesity as those in extreme poverty do not have resources to become obese while individuals who are slightly well off but still poorer as compared to the population, could maintain a positive energy balance for a long span of time<sup>2</sup>. People from disadvantaged socio economic background tend to practice more unhealthy behaviors due to low self-esteem which lead to greater health complications<sup>58, 59</sup>.

Contradictory results have been reported whereby low SES individuals have been found to choose nutritious foods<sup>58</sup>. In Canada, higher income individuals are more likely to follow dietary recommendations due to greater awareness of relationships between diet and diseases and are also less resistant to change<sup>60</sup>. Obesity has also been found to be more prevalent in higher socio economic groups in rural India<sup>61</sup>.

In developed countries, SES was inversely related to obesity in women but not in men<sup>62</sup>. Among Chinese men, a positive relation was identified between income and obesity and in developing countries, a positive correlation between obesity and SES was noted in both gender<sup>62</sup>. Fast food consumption was also reported to be higher in low income individuals since they have easier access to fast food restaurants than to supermarkets where fresh foods are available, resulting in high frequency of fast food consumption<sup>63</sup>. It is noted, however, that both high and low income individuals rely on fast foods and hence, have higher energy intakes<sup>64</sup>.

### Snacking

Meal and snack patterns have been linked with energy intake among US adults<sup>65</sup>. Total snacking was found to increase about 24% in all adults, with a higher increase observed from 1997-1978 to 2003-2006<sup>66</sup>. Moreover, sweet and fatty food groups are linked with snacking<sup>67</sup>. While younger Malaysian adults derive high energy intakes from morning meals and dinner, older adults have lower intakes from these meals<sup>68</sup>. Among older adults, the prevalence of snacking is 84% and contributes a quarter of their daily energy, with each snacking occasion contributing approximately 150 kcal<sup>11</sup>. Duffey *et al.* (2013) also reported that in Brazil, snacking is a major source of daily energy intake with the lowest % of daily energy intake from snacks among the 40-59 age group<sup>69</sup>. Multiple snackers have higher energy intakes than those who never snack<sup>70</sup>. However, the notion that high energy intake from snacks contributes to weight gain has been challenged by Drummond *et al.* (1996) and Dongen *et al.* (2010) who advocated that snacking may not necessarily result in weight gain<sup>71, 72, 73</sup>. One plausible reason is because people can opt for snacks containing high fiber foods such as dried prunes that tend to increase satiety and decrease energy intake<sup>74</sup>.

### Portion sizes and access to foods

Food service portion sizes, including fast food and ready-to-eat foods have increased substantially over the past 20 years and it is most likely that individuals are unaware of the amount of food they consume<sup>75</sup>. Portion sizes are common everywhere from restaurants to supermarkets to vending machines<sup>76</sup> and consumers eat 30 to 50 %

more from larger-sized restaurant portions compared to smaller portions<sup>75</sup>. When portion size and energy density are increased, they act synergistically to increase energy intake<sup>76</sup>. Chronic exposure to large portion sizes was found to result in a rise in energy intake and consequently, weight gain over time among middle aged individuals<sup>77</sup>. A 50% increase in portion size can cause a rise in daily energy intake by 16% in middle aged adults<sup>78</sup>. Moreover, a high prevalence of obesity has been reported with quick service restaurants<sup>76</sup>. Increases in body weight and fatness are also associated with high consumption of fast foods which leads to increased energy intakes in middle aged women<sup>63, 79</sup>. However, so far this trend has been restricted to the US and western countries and it is unclear whether the frequency of eating out is related to high BMI in Asian countries as well<sup>80</sup>. It can also be argued that the effect of portion size on energy intake has little effect on body weight since individuals may compensate for their high food intake by eating less at the following meal<sup>81</sup>.

Food accessibility may be a factor contributing to greater consumption of food and hence, a high energy intake. The more accessible a food, the more it is consumed<sup>75</sup>. In some rural areas, access to transport is difficult and food insecurity may result due to poor health and limited food availability owing to inadequate grocery stores in the neighborhood. Physical disabilities may also impede food intake related activities, such as shopping and cooking, leading to pronounced consequences on eating behavior<sup>82</sup> but Dressler *et al.* (2013) reported that food security and BMI are not necessarily related<sup>83</sup>.

### Social factors

In developed countries, a positive association between marriage and BMI was demonstrated<sup>84</sup>. The same trend was observed in developing countries as well<sup>84</sup>. In Jamaica, both men and women who were married were found to have higher BMI. This has been attributed to the fact that important events in life may lead to positive energy balance and precipitate the onset of obesity<sup>85</sup>. Among Chinese adults, marital status was positively related to BMI in men<sup>52</sup>. While the dietary food habits of people who were never married consisted of potatoes and red meat, those who were married ate more fish, nuts and legumes. Those who were never married also consumed

more fast foods and drank less alcohol than married or widowed individuals; however, no significant relationship was reported between marital status, BMI and cholesterol levels<sup>86</sup>. Similarly, with reference to marital status, no differences were observed for both males and females in terms of obesity<sup>87</sup>.

While living alone had a great negative impact on dietary habits and nutrient intakes of men, women on the other hand, were found to have nutrient intakes equal or greater than those of women living with a spouse<sup>88</sup>. People living alone were not only at higher nutritional risk but also consumed less meals, had lower intakes of protein, fruits and vegetables as well as a low BMI<sup>10</sup>. Moreover, elderly individuals who live alone are more at risk for anorexia of aging and other health problems<sup>10</sup>. Widowhood results in higher vulnerability for under nutrition due to reduced food intake as a result of decreased participation in social activities, changes in eating patterns and in social relationships<sup>10</sup>. Widowhood may also result in social isolation which can reduce social contact and increase risk for the development of depression. Social isolation results in a higher number of meals eaten alone, which was found to be associated with 30% lower energy intake<sup>10</sup>.

### Physical Activity Level

Physical activity, considered as an important determinant of body weight can prevent obesity<sup>89</sup>. PA is known to contribute to an improvement in energy and macronutrient balance regulation<sup>90</sup>.

Globally, more than 30% of adults are not sufficiently active<sup>91</sup>. Physical activity is closely interrelated with energy intake<sup>92</sup> as it has the ability to manipulate energy expenditure and when performed on a regular basis, it leads either to loss of body weight or to a need for an increase in energy intake<sup>92</sup>. Weight loss may not occur if people increase their caloric intake after exercise but the extent to which this compensation takes place remains unresolved<sup>93</sup>. An increase in physical activity leads to a rise in food intake so that energy balance is maintained, but the contrary is not true<sup>94</sup>. It has also been observed that people engaged in physical activity regularly are less likely to gain weight. Among Malay adults a negative association between moderate to high physical activity level and metabolic syndrome was reported<sup>95</sup>. In Mauritius, high physical activity

level is linked to better eating habits among older adults but middle aged women who were engaged in moderate physical activity were found to be overweight<sup>9</sup>. Physical activity is known to decrease with age<sup>96</sup>. However, Indian women aged 51-60 were found to engage in heavy activities as compared to the other age groups (middle aged and young women)<sup>97</sup>. Overweight individuals were reported to have lower physical activity than their normal weight counterparts and small significant relationships were obtained between body fatness and physical activity, however, more research is required to establish a strong link<sup>98</sup>. Moreover, significant associations between sedentary behaviors and weight gain are small<sup>99</sup> and Donnelly *et al.* (2014) argued that physical activity level does not have any effect on energy intake<sup>100</sup>. Physical activity may also differ according to gender as demonstrated in Korean Americans, where men are more engaged in frequent physical activity than women in late life<sup>101</sup>. In another study, physical activity was negatively associated to BMI in women but not in men<sup>58</sup>.

### Nutrition Knowledge (NK)

Education may be associated with increased NK as well as with the ability to translate NK into better health practices<sup>102</sup>. In a study, it was observed that a high proportion of older adults in England had little basic NK which was a barrier to healthier eating<sup>13</sup>. People with a good NK are likely to make healthier food choices. For instance, elders' NK of dairy products predicted the type of milk consumed<sup>13</sup>. However, nutritional knowledge is not always consistent with healthy eating habits or adequate energy intake as shown in a study where consumption of several food groups increased with high nutrition knowledge except for fruits and vegetables<sup>9</sup>. A high NK can enable people to improve their nutrition practices and establish desirable eating habits to maintain health<sup>103</sup>. Women have higher NK scores and more negative views of fatty foods, sweets and salty food items than men<sup>13</sup>. Knowledge of fat nutrition in middle aged women led to consumption of low fat diets<sup>47</sup>. Participants having lower education and hence, most probably lower NK consumed less fish and vegetables but more fried foods, pasta and potatoes<sup>104</sup>. However, no negative association was reported between nutrition knowledge and fat intakes<sup>105</sup>. High nutrition knowledge may not necessarily lead to a healthy

diet [106]. Where obese people are concerned, they may find it difficult to translate knowledge into practice<sup>107</sup>.

#### Dental health/oral status

Dentition has been found to form part of the factors that can increase the risk of malnutrition in elderly people<sup>108</sup>. A similar observation was made in another study where tooth loss mouth hygiene, xerostomia and periodontal disease were found to be related to a decrease in taste sensitivity<sup>10</sup>. A decrease in sensitivity usually results in decreased food consumption and eventually to the anorexia of aging<sup>10, 109</sup>. Elderly people may be subject to dietary restrictions due to oral problems such as fewer natural teeth, impaired dentition or dental caries<sup>110</sup>. Elderly people having compromised functional dentition were reported to have inadequate calorie intake<sup>111, 113</sup>. While a significant association was reported between dental status and dietary intakes in elderly individuals<sup>112</sup>, this was found to be more factual for micronutrients but true to a lesser extent for energy intake<sup>112</sup>. Moreover, despite having dental

impairment or chewing problems, elderly people may not necessarily exclude any food type from their diets<sup>114</sup>.

#### CONCLUSION

This review provides insights into the various factors which may impact on energy intake of middle aged and elderly individuals and there is ample evidence to suggest that the factors discussed do have an influence on energy intake. It is also evident from published studies that eating habits with regular consumption of certain food groups have an effect on energy intake. Although evidence does point out that these factors are associated with energy intake, further research and follow up studies are necessary to establish stronger associations between energy intake and the factors discussed. It is also useful to consider these factors while devising new strategies or nutrition interventions to address issues on energy intake, eating habits and obesity among the middle aged and elderly population.

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