Mini Review

Paradoxes with weight disorders for health systems

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The body mass index (BMI) has served public health and clinical medicine well in the recognition of obesity. However, its use has generated some instructive paradoxes and misunderstandings which argue for the appreciation of body compositional disorders (BCD) as such and, in particular, for the parallel evaluation of muscle mass with a definition of 'orthosarcal' conditions to enable the early detection of sarcopenia. Across the life-span, and with gender and ethnic differentials, BCD is basic to the full spectrum of nutritionally-related disorders and diseases. In the case of metabolic diseases like diabetes, muscle, fatness and its distribution, and even bone seem to play pathogenetic roles. Optimal body fat and distribution are relevant to child development, maternal health and healthy ageing, with much more to learn about the mechanisms. The economic and societal costs of obesity tend to increase progressively with the BMI, but the health outcomes, at least for mortality, are J-or U-shaped. With some established chronic diseases, like diabetes, renal failure or cardiac failure, overfatness may be protective; sometimes this may be because contaminant fat-soluble endocrine disrupters are segregated in fat tissue. This means that some of the relatively favourable survival in the elderly who have more body fat is at the expense of the health care system. Younger children with chronic energy deficiency, on the other hand, may succumb before expenditure saves them. In these respects, our species is more vulnerable than we have thought. Fortunately, a better understanding of BMI and health is emerging.

Key Words: nutritional economics, obesity paradox, endocrine disrupters, sarcopenic obesity, orthosarcal

PARADOX

As the body mass index (BMI) has received acceptance in public health and clinical medicine, so have its limitations become more apparent. These are fundamentally that it was developed in Caucasians as a way of accentuating the contribution of fat to weight in the numerator and that it applies to sedentary people. Nevertheless, it has served health workers well as they became more familiar with it after its advocacy by George Bray in 1992,[1] although its origins were with Adolphe Quetelet in 1832 and termed BMI by Ancel Keys in 1972.[2]

There is little doubt that higher BMIs, and presumptively excess body fat, can increase mortality across cultural boundaries with an optimal range of 22.5–25.0 kg/m^2,[3] sufficient for WHO to recommend a healthy BMI range for international reference and comparison (18–24.9 kg/m^2), but with that for Asian populations lower (suggested range for increasing but acceptable risk of 18.5–23 kg/m^2).[4,5] The risk for mortality is J-or U-shaped. This risk varies in accordance with age, gender, socioeconomic status, associated personal behaviours, body fat distribution and more.[3]

Yet several paradoxes have emerged with the growing global prevalence of obesity. The term 'obesity paradox' was first used to describe clinical conditions in which a higher BMI was associated with longer survival than with lower BMIs in renal disease (dialysis), cardiac failure and diabetes.[6-10] More broadly, the paradoxes include increasing life expectancy in most places where obesity is becoming more common,[11,12] the deceptive and concurrent increase in weight as fat and decreases in lean mass as muscle and bone occur,[13] the shift with ageing to higher BMIs (which relate increasing weight to decreasing height) which predict longer life expectancy but more disability and disease (including loss of height),[13-16] and the finding that, in type 2 diabetes, normal-weight people have a higher mortality than those with higher BMIs.[17]

LIVING LONGER WITH OBESITY BUT COSTING MORE

For some time, the soaring health, social and economic costs associated with obesity and its consequences in developed economies have created concern about health system affordability and sustainability[18-21] while even greater concerns are increasingly expressed about transitional and less developed economies.[22,23] There is little doubt that greater disability with obesity contributes to these costs as successive National Health and Nutrition Surveys (NHANES)[24] and Health and Retirement Study (HRS)[25] reports in the USA show for all age groups.[26]

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Reither *et al* [12] forecast that the development of obesity among younger generations will lead to an accumulation of health risks in the community and contribute to more health care expenditure and increased mortality than presently envisaged. This is seen in the impact of the metabolic syndrome, which is closely linked to obesity,[27] which identifies problems in energy regulation with many over fatness-related disorders and diseases[28] and which contributes to disproportionately high medical expenditure among elderly Taiwanese men.[29]

The link between obesity and disability, in its major forms of joint disease, mental health, learning and back ailments, may be bidirectional and this is most evident in children, but also in adults.[30-32] Thus, there may be a vicious cycle of obesity and disability from early life. With advancing years this cycle will be accentuated by the advent of increasing numbers of obesity-related health problems, some well-known like diabetes and cardiovascular and respiratory disease and others less recognised like neoplastic disease[33] and neurodegenerative disease[34] and mental health problems.[35]

In a major population study of 111,949 examinees in Taiwan, Pan *et al*[36] confirmed the U-shaped relationship between BMI and all-cause mortality, but found that, even through the so-called normal BMI range, medical expenditure progressively increased and on either side. Especially in the aged, medical expenditure continues to rise with increasing BMI, but there is little if any adverse association with mortality. It would appear, therefore, that there are increased costs associated with the maintenance of favourable life expectancy in the face of the increased obesity prevalence.

It is not just the health costs of obesity which have economic consequences for affected individuals and society, but also the opportunity costs through effects on workforce participation and livelihoods.[20,37,38] The added difficulty is that the socio-economically disadvantaged are at added risk of obesity in any case.[39]

At a time of continuing international financial crisis, in the wake of the global financial crisis of 2008, expenditure to limit the expression of mortality and accommodate disability represents hidden health vulnerability in the population. This is now evident in those countries in the Euro-zone with demanding terms for debt alleviation, including cut-backs to health system funding. So whereas the ability to store energy as fat may have represented survival advantage at various points in the human experience, that may have changed for at least the immediate if not the distant future and for more and more jurisdictions.

SARCOPENIC OBESITY AS A BODY COMPOSITIONAL DISORDER

There is an increasing appreciation that not just fat distribution, but also body composition is an important set of concomitant predictors, along with body fatness, of longevity. It would be preferable to speak of body compositional disorders (BCD) rather than BMI in isolation or even 'weight disorders', given that the latter terminology is simple and explicable when it comes to the required 'health literacy'.

There is a need to measure muscle, bone and other organ mass separately and collectively as health indices reflected in weight: and there is evidence that, for a given level of fatness, its health relevance is dependent on physical fitness.[40] Reduced muscle mass or sarcopenia and muscle strength which are associated with ageing are themselves important predictors of morbidity and mortality. A skeletal muscle index , like the BMI could,therefore, be helpful in the evaluation of sarcopenia.[41,42] This muscle phenomenon may occur in the presence of over fatness, a situation which may be referred to as sarcopenic obesity.[43-45] To maintain healthy muscle mass and function might be considered 'orthosarcal', etymologically 'correct flesh'.

In Asian populations, less muscle mass than in Europeans may be a factor in the expression of metabolic disease even when there is less body fat.[46,47]

HOW MIGHT THE OBESE WITH CHRONIC DISEASE LIVE LONGER THAN THE LEAN?

There are at least two ways in which the obese with chronic disease live longer than the lean. The first is that the lean may be sarcopenic and more liable to shorter lives than the obese. Obesity *per se* is associated with more lean mass, both muscle and bone in healthy individuals and some of this body compositional advantage may carry over into the phase of chronic disease. In cardiac failure, the obese may have more cardiac muscle reserve. The second is that fat soluble pollutants, like certain endocrine disrupters, may be retained in fat tissue and, therefore, be less harmful than in lean individuals. This has been described for obese and non-obese people with diabetes.[17]

LEAN BODY MASS AND MORTALITY

Few studies have investigated the association between lean body mass and mortality among the elderly.[47] A longitudinal study among the elderly in Korea showed that a lean mass index was an independent predictor of 3-yr mortality.[47] That study controlled for age, sex, hypertension, diabetes, and the presence of chronic disease, but not BMI. An unpublished study in Chinese has further demonstrated that a low skeletal muscle index predicts mortality risk, independent of BMI and other confounders. Therefore, aside from BMI, a lean body mass plays an important role in mortality risk among the elderly.

WEIGHT CHANGE AND MORTALITY AMONG THE ELDERLY

In the general population, weight reduction is beneficial for severely obese individuals.[48] However, weight reduction among the elderly is not recommended. Compared to elderly individuals with a stable weight, weight loss is associated with a higher risk of mortality among elderly Chinese[49] and Americans.[50,51] Moreover, a reduction in appendicular or leg fat-free mass is the main predictor of disability among the elderly.[52] Additional studies also show that both involuntary and voluntary (usually diet control) weight loss increases the risk of mortality among the elderly.[53] Thus, weight loss in the elderly may lead to increased mortality, even if the weight is lost intentionally by diet. A loss of muscle mass often accompanies weight reduction,[51,54] which may explain why elderly persons who lose weight have a higher mortality risk.

AGE (ESPECIALLY AGEING) AND OPTIMAL BMI (BEING HEAVIER)

BMI is not reliably predictive of excess mortality in the aged[14] except below 25 and above 30 or even 35.[55] Disability is also increased with BMIs below 18.5 and above 30. Physical activity and function are conjointly important in the risk presented by BMI to health outcomes in the aged.[44] Weight management in the aged presents particular difficulty in the aged for various reasons, especially with reduced physical activity and oedematous conditions. But knowing its trajectory and what the body composition is will go a long way to aid the clinician who can then base decisions not only on the associations of BMI and mortality.[13,15,16]

THOSE WITH CED (BMI <18.5) COST LESS AND DIE EARLIER

Pan *et al* find that at low BMIs, with chronic energy deficiency (CED), health care expenditure is least and, as is already known, this region of the J or U-shaped curve has a relatively higher mortality. This human tragedy remains a feature of global poverty and hunger.[56] It is more poignant when those who smoke or have cancer at baseline are removed from this part of the analysis. They are likely to have secondarily low BMIs as opposed to a primary nutritional disorder. Notably, in those with BMI >18.5 it is inversely related to mortality from respiratory disease and senility.

Inasmuch as the problem of CED is one of sarcopenia, since with energy deficiency muscle is utilized, it can be found at any level of body fatness and this may relate to dietary quality.[44,56,57] as well as to physical inactivity.

Fat is an essential and multifunctional tissue important for physical and mental health and for the integrity of body systems (eg, immune and endocrine) and organ function with which it is closely associated (eg, skeletal and cardiac muscle; perinephric and lymph node; on the portal circulation to liver from omental fat). Elders with CED, residual fat mass may be a survival factor since some remains with BMIs <18.5.[44] The question is whether fat could or should not be mobilized in such states.

COMPETING RISKS FOR DYING AND QUALITY-OF-LIFE

The links between obesity and quality-of-life, which is partly a question of disability, and between obesity and mortality may not remain the same and may be diminishing as a secular trend.[11] This may simply be that, while obesity presents risk, these risks may be mediated through correctable pathways to major outcomes like diabetes, cancer and cardiovascular disease or other risk domains, like smoking or physical inactivity and which may have been addressed. So the future burden of obesity-related disease, if its prevalence and costs continue to increase, will depend on whether obesity itself or other health risk factors dominate.

THE OVER-RIDING IMPORTANCE OF ECOSYSTEM AND PHYSICAL ACTIVITY

While BMI is a useful index of body fatness in sedentary populations, is does not take into adequate account the body compositional changes associated with physical fitness or other environmental inputs.[58] The increasing health care costs, which pay for disability management and acute care to prolong life as BMI increases, may be addressed to some extent by striving for fitness and healthy body composition.[59] Active and satisfying lives depend on the locality and household in which we live, work and recreate.[60-62] For affordable and sustainable approaches to body composition, our ecosytems must be conducive (UN System, Ecosystem management manual).[63]

AUTHOR DISCLOSURE

Neither author has a conflict of interest in relation to this paper

REFERENCES

1. Bray GA. Pathophysiology of obesity. Am J Clin Nutr. 1992; 55(2 Suppl):488S-94S.
2. Eknoyan G. Adolphe Quetelet (1796-1874) -- the average man and indices of obesity. Nephrol Dial Transplant. 2008; 23:47-51.
3. Whitlock G, Lewington S, Sherliker P, Clarke R, Emberson J, Halsey J, Qizilbash N, Collins R, Peto R. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009;373:1083-96.
4. James WP, Chunming C, Inoue S. Appropriate Asian body mass indices? Obes Rev. 2002;3:139.
5. WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363:157-63.
6. Mosterd A, Cost B, Hoes AW, de Bruijne MC, Deckers JW, Hofman A, Grobbee DE. The prognosis of heart failure in the general population: The Rotterdam Study. Eur Heart J. 2001;22:1318-27.
7. Lavie CJ, Milani RV. Obesity and cardiovascular disease: the hippocrates paradox? J Am Coll Cardiol. 2003;42:677-9.
8. Diercks DB, Roe MT, Mulgund J, Pollack CV Jr, Kirk JD, Gibler WB, et al. The obesity paradox in non-ST-segment elevation acute coronary syndromes: results from the Can Rapid risk stratification of Unstable angina patients Suppress Adverse outcomes with Early implementation of the American College of Cardiology/American Heart Association Guidelines Quality Improvement Initiative. Am Heart J. 2006;152:140-8.
9. Habbu A, Lakkis NM, Dokainish H. The obesity paradox: fact or fiction? Am J Cardiol. 2006;98:944-8.
10. Schmidt DS, Salahudeen AK. Obesity-survival paradox-still a controversy? Semin Dial. 2007;20:486-92.
11. Mehta NK, Chang VW. Secular declines in the association between obesity and mortality in the United States. Popul Dev Rev. 2011;37:435-51.
12. Reither EN, Olshansky SJ, Yang Y. New forecasting methodology indicates more disease and earlier mortality ahead for today's younger Americans. Health Aff. 2011;30: 1562-8.
13. Zamboni M, Mazzali G, Fantin F, Rossi A, Di Francesco V. Sarcopenic obesity: a new category of obesity in the elderly. Nutr Metab Cardiovasc Dis. 2008;18:388-95.
14. Blackberry I, Kouris-Blazos A, Wahlqvist ML, Steen B, Lukito W, Horie Y. Body mass index is not a significant predictor of survival amongst older people. Asia Pac J Clin Nutr. 2004;13:S137.
15. Decaria JE, Sharp C, Petrella RJ. Scoping review report: obesity in older adults. Int J Obes. 2012;36:1141-50.
16. Zamboni M, Mazzali G. Obesity in the elderly: an emerging health issue. Int J Obes. 2012;36:1151-2.
17. Lee DH, Lind L, Jacobs DR, Jr., Salihovic S, van Bavel B, Lind PM. Associations of persistent organic pollutants with

abdominal obesity in the elderly: The Prospective Investigation of the Vasculature in Uppsala Seniors (PIVUS) study. Environ Int. 2012;40:170-8.
18. Aitken RJ, Allman-Farinelli MA, King LA, Bauman AE. Current and future costs of cancer, heart disease and stroke attributable to obesity in Australia - a comparison of two birth cohorts. Asia Pac J Clin Nutr. 2009;18:63-70.
19. Hu HY, Chou YJ, Chou P, Lee CH, Lee MC, Huang N. Association between obesity and medical care expenditure among Taiwanese adults. Asia Pac J Clin Nutr. 2008;17: 492-504.
20. Kouris-Blazos A, Wahlqvist ML. Health economics of weight management: evidence and cost. Asia Pac J Clin Nutr. 2007;16(Suppl 1):329-38.
21. Wellman NS, Friedberg B. Causes and consequences of adult obesity: health, social and economic impacts in the United States. Asia Pac J Clin Nutr. 2002;11 Suppl 8:S705-9.
22. Gill T. Epidemiology and health impact of obesity: an Asia Pacific perspective. Asia Pac J Clin Nutr. 2006;15(Suppl):3-14.
23. Lukito W, Wahlqvist ML. Weight management in transitional economies: the "double burden of disease" dilemma. Asia Pac J Clin Nutr. 2006;15(Suppl):21-9.
24. Alley DE, Chang VW. The changing relationship of obesity and disability, 1988-2004. JAMA. 2007;298:2020-7.
25. Sturm R, Ringel JS, Andreyeva T. Increasing obesity rates and disability trends. Health Aff. 2004;23:199-205.
26. Rand Corporation (Rand Health). [cited 2012/9/16]; Available from: http://www.rand.org/content/dam/rand/pubs/research_briefs/2007/RAND_RB9043-1.pdf
27. Yang FY, Wahlqvist ML, Lee MS. Body mass index (BMI) as a major factor in the incidence of the metabolic syndrome and its constituents in unaffected Taiwanese from 1998 to 2002. Asia Pac J Clin Nutr. 2008;17:339-51.
28. Wahlqvist ML, Chang HY, Chen CC, Hsu CC, Chang WC, Wang WS, Hsiung CA. Is impaired energy regulation the core the metabolic syndrome in various ethnic groups of the USA and Taiwan? BMC Endocrine Disorders. 2010;10:11.
29. Chang YH, Chen RCY, Lee MS, Wahlqvist ML. Increased medical costs in elders with the metabolic syndrome are most evident with hospitalization of men. Gender Medicine. 2012;doi:10.1016/j.genm.2012.08.005 [Epub ahead of print].
30. Bandini LG, Curtin C, Hamad C, Tybor DJ, Must A. Prevalence of overweight in children with developmental disorders in the continuous national health and nutrition examination survey (NHANES) 1999-2002. J Pediatr. 2005; 146:738-43.
31. Chen AY, Kim SE, Houtrow AJ, Newacheck PW. Prevalence of obesity among children with chronic conditions. Obesity. 2010;18:210-3.
32. Ells LJ, Lang R, Shield JP, Wilkinson JR, Lidstone JS, Coulton S, Summerbell CD. Obesity and disability - a short review. Obes Rev. 2006;7:341-5.
33. World Cancer Research Fund/American Institute for Cancer Research. [cited 2012/9/16]; Available from: http://www.dietandcancerreport.org/expert_report/index.php.
34. Hsu CC, Wahlqvist ML, Lee MS, Tsai HN. Incidence of dementia is increased in type 2 diabetes and reduced by the use of sulfonylureas and metformin. J Alzheimers Dis. 2011; 24:485-93.
35. Simon GE, Von Korff M, Saunders K, Miglioretti DL, Crane PK, van Belle G, Kessler RC. Association between obesity and psychiatric disorders in the US adult population. Arch Gen Psychiatry. 2006;63:824-30.
36. Pan WH, Yeh WT, Chen HJ, Chuang SY, Chang HY, Chen L, Wahlqvist ML. The U-shaped relationship between BMI and all-cause mortality contrasts with a progressive increase in medical expenditure: a prospective cohort study. Asia Pac J Clin Nutr. 2012;21:577-87.
37. Murphy C, Yates J. Economic comparison of weight loss programmes versus drug treatment for the management of obesity. Asia Pac J Clin Nutr. 2005;14:97-105.
38. Yates J, Murphy C. A cost benefit analysis of weight management strategies. Asia Pac J Clin Nutr. 2006;15 (Suppl):74-9.
39. Drewnowski A, Darmon N. Food choices and diet costs: an economic analysis. J Nutr. 2005;135:900-4.
40. Bennett WL, Ouyang P, Wu AW, Barone BB, Stewart KJ. Fatness and fitness: how do they influence health-related quality of life in type 2 diabetes mellitus? Health Qual Life Outcomes. 2008;6:110.
41. Kim TN, Park MS, Yang SJ, Yoo HJ, Kang HJ, Song W, et al. Prevalence and determinant factors of sarcopenia in patients with type 2 diabetes: the Korean Sarcopenic Obesity Study (KSOS). Diabetes Care. 2010;33:1497-9.
42. Janssen I, Heymsfield SB, Ross R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. J Am Geriatr Soc. 2002;50:889-96.
43. Landi F, Liperoti R, Fusco D, Mastropaolo S, Quattrociocchi D, Proia A, Tosato M, Bernabei R, Onder G. Sarcopenia and mortality among older nursing home residents. J Am Med Dir Assoc. 2012;13:121-6.
44. Lee MS, Chen RCY, Chang YH, Huang YC, Wahlqvist ML. Physical function mitigates the adverse effects of being thin on mortality in a free-living older Taiwanese cohort. J Nutr Health Ageing. 2012. doi: 10.1007/s12603-012-0379-3.
45. Morley JE, Baumgartner RN, Roubenoff R, Mayer J, Nair KS. Sarcopenia. J Lab Clin Med. 2001;137:231-43.
46. Srikanthan P, Hevener AL, Karlamangla AS. Sarcopenia exacerbates obesity-associated insulin resistance and dysglycemia: findings from the National Health and Nutrition Examination Survey III. PLoS One. 2010;5: e10805.
47. Han SS, Kim KW, Kim KI, Na KY, Chae DW, Kim S, Chin HJ. Lean mass index: a better predictor of mortality than body mass index in elderly Asians. J Am Geriatr Soc. 2010; 58:312-7.
48. Flegal KM, Graubard BI, Williamson DF, Gail MH. Cause-specific excess deaths associated with underweight, overweight, and obesity. JAMA. 2007;298:2028-37.
49. Woo J, Ho SC, Sham A. Longitudinal changes in body mass index and body composition over 3 years and relationship to health outcomes in Hong Kong Chinese age 70 and older. J Am Geriatr Soc. 2001; 49:737-46.
50. Newman AB, Yanez D, Harris T, Duxbury A, Enright PL, Fried LP. Weight change in old age and its association with mortality. J Am Geriatr Soc. 2001;49:1309-18.
51. Lee CG, Boyko EJ, Nielson CM, Stefanick ML, Bauer DC, Hoffman AR, et al. Mortality risk in older men associated with changes in weight, lean mass, and fat mass. J Am Geriatr Soc. 2011;59:233-40.
52. Fantin F, Di Francesco V, Fontana G, Zivelonghi A, Bissoli L, Zoico E, et al. Longitudinal body composition changes in old men and women: interrelationships with worsening disability. J Gerontol A Biol Sci Med Sci. 2007;62:1375-81.
53. Wallace JI, Schwartz RS, LaCroix AZ, Uhlmann RF, Pearlman RA. Involuntary weight loss in older outpatients: incidence and clinical significance. J Am Geriatr Soc. 1995; 43:329-37.
54. Villareal DT, Chode S, Parimi N, Sinacore DR, Hilton T, Armamento-Villareal R, Napoli N, Qualls C, Shah K. Weight loss, exercise, or both and physical function in obese older adults. N Engl J Med. 2011; 364:1218-29.
55. Al Snih S, Ottenbacher KJ, Markides KS, Kuo YF, Eschbach K, Goodwin JS. The effect of obesity on disability vs mortality in older Americans. Arch Intern Med. 2007; 167:774-80.

56. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. Am J Clin Nutr. 2004;79:6-16.
57. Lee MS, Huang YC, Su HH, Lee MZ, Wahlqvist ML. A simple food quality index predicts mortality in elderly Taiwanese. J Nutr Health Aging. 2011;15:815-21.
58. Bjorntorp P. Metabolic implications of body fat distribution. Diabetes Care. 1991;14:1132-43.
59. Wahlqvist M, Savige G, Lee D, Snelson B. Agefit - Fitness and Nutrition for an independent future. Melbourne: MacMillan Australia; 2001.
60. Wahlqvist ML. Eco-nutritional disease or nutrition and chronic disease. Asia Pac J Clin Nutr. 2002;11(Suppl):S753-4.
61. Wahlqvist ML. Connected Community and Household Food-Based Strategy (CCH-FBS): its importance for health, food safety, sustainability and security in diverse localities. Ecol Food Nutr. 2009;48:457-81.
62. Wahlqvist ML, Specht RL. Food variety and biodiversity: econutrition. Asia Pac J Clin Nutr. 1998;7:314-9.
63. Ash N, Blanco H, Brown C, Garcia K, Henrichs T, Lucas N, et al. Ecosystems and human wellbeing: a manual for assessment practitioners. Washington, DC: Island Press; 2010.

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體重失調矛盾

身體質量指數(BMI)為公共衛生與臨床醫學中肥胖判定的常用依據。然而它的使用卻也造成一些矛盾及誤解，例如體組成失調(BCD)的判定爭論，特別是用在以肌肉質量為評估指標之肌少症的早期偵測並不適當。在生命週期中，身體組成會隨著性別、年齡與種族而有所差異，而身體組成異常疾病通常是導因於個人相關營養需求失調及慢性疾病。譬如在代謝異常的糖尿病患中，肌肉、脂肪甚至骨質的分布可能是影響其代謝異常發展的重要機轉之一。因此，理想的體脂肪量及分布與孩童的發展、母親健康及健康老化的機制密切相關。整體而言，肥胖所導致的經濟及社會成本是伴隨 BMI 的增加而提高，但 BMI 和死亡率卻是呈現 J 或是 U 型的關係。在慢性病患中，例如糖尿病、腎衰竭或是心衰竭，較多體脂肪的人可能有較低的死亡風險；可能是因為較肥胖者有較多的心肌維持生命或者是因為脂肪細胞阻絕環境汙染因子對肌肉細胞的傷害。這些因素可能解釋健康照護系統中，體脂肪較高的老人，其存活率相對較高。因此，因果相關倒置的現象不應該被忽略。另一方面，熱量缺乏的幼童，可能在未獲得足夠能量前即死亡。在這樣的觀點中，人類比我們自己想像的還要脆弱。所幸，我們逐漸了解 BMI 及健康關係。

關鍵字：營養經濟、肥胖矛盾、內分泌干擾物、肌少症肥胖、orthosarcal (健康的肌肉)