Research Article
Aging: The Evolution of Body Weight and Its Relation to the Complexity of Organism

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Abstract: The object of study is to evaluate the relationship between the evolution of body weight as well as the evolution of the complexity of the human body throughout life.Aging is characterized by the gradual loss of homeostasis and a reduction in the capacity for generating body mass. The study, in human beings, of the evolution of weight and the capacity to generate body mass shows a high correlation with that of the evolution of the complexity of the organism throughout life. Thus, the evolution of the complexity of the organism throughout life seems to be related to the aging process. The reason the capacity for generating mass is reduced during aging was not investigated; at the same time, what promotes the evolution of complexity was not questioned.

Keywords: Age, body weight, complexity, generating body mass capacity

INTRODUCTION

We understand aging as a gradual reduction in the capacity to generate body mass (Jackson *et al*., 2012; Zunzunegui *et al*., 2012; Hollander *et al*., 2012) and a gradual decline of homeostasis (Novosel'tsev and Novosel'tseva, 2011; Teplyuk, 2012).

Beyond the different theories about aging (Barzilai *et al*., 2012; Miquel, 2006; Barja, 2005), the format of the process is not the same in all living creatures, but it is related to the degree of complexity of them (Ottaviani and Franceschi, 2012; Bhattacharyya, 2012).

The aging process is less remarkable at lower complexity and more remarkable in a more complex process (Galliot, 2012; Eldar, 2012).

In this study we will verify the relationship between the reduction of the capacity to generate body mass that occurs with age and the degree of complexity of the organism.

The generated mass can be estimated by studying the evolution of body weight throughout life (Sánchez and Barragán, 2011; Sánchez and Barragán, 2010).

The concept of generated mass must be distinguished from the ability to generate it, although both concepts are related. The ability to generate mass can be estimated as a delta of body weight between two consecutive moments of life.

It is intended to find out up to what point the process of body mass increase continues and whether this process is accompanied by an increase in complexity (Jackson *et al*., 2012). This is a matter of interest, as some authors consider aging as a loss of complexity. (Lipsitz and Goldberger, 1992; Goldberger *et al*., 2002). From their conception organisms increase their body mass while they increase their complexity: they develop different types of cells, tissues, organs, organ systems.

Considering the complexity in terms of the number of different types of specialized cells that make up an organism, it seems clear that complexity increases if the number of different cell types is increased at some point in life. If at that time the body continues to increase its mass without increasing the number of cell types, a structural simplification related to the greatest generated mass would exist. One of the latest specialized cell types makes its appearance during puberty: the gametes or sex cells (Teplyuk, 2012; Parma and Radi, 2012). Thus, the complexity of the organism, reaches its highest point. The relationship between the degree of complexity of the organism and the evolution of its capacity to generate body mass, may help to explain the relationship between the complexity of the organisms and the appearance of aging. The objectives are:

- Describe the evolution of body weight in humans throughout life
- Describe the evolution of the ability to generate mass in human beings, in terms of body weight delta throughout life
- Analyze the relationship between the evolution of body weight and body weight delta throughout life in human beings

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Table 1: Evolution of body weight during the lifespan of healthy men, taken and modified from Parma and Radi (2012)

Category	Age (years)	Bodyweight(kg)
1 Infants	0, 0-0, 5	6
2	0, 5-1, 0	9
3Boys	1–3	13
4	4-6	20
5	7-10	28
6Men	11-14	45
7	15-18	66
8	19-24	72
9	25-50	79
10	51+	77

The increase of body weight over the course of a lifetime in healthy men

Table 2: Evolution of body weight over human life in healthy women, taken and modified from Ottaviani and Franceschi (2012)

Category	Age (years)	Bodyweight(kg)
1 Infants	0, 0-0, 5	6
2	0, 5-1, 0	9
3 Girls	1-3	13
4	4-6	20
5	7-10	28
6 Women	11-14	46
7	15-18	55
8	19-24	58
9	25-50	63
10	51+	65

The increase of body weight over the course of a lifetime in healthy women

Table 3: Evolution of Delta Body Weight (DBW) during the lifespan of healthy men, taken and modified from Parma and Radi (2012)

Category	Age (years)	Bodyweight(kg)	DBW(kg)
1 Infants	0, 0 - 0, 5	6	-
2	0, 5 - 1, 0	9	3
3Boys	1-3	13	4
4	4-6	20	7
5	7-10	28	8
6Men	11-14	45	17
7	15-18	66	21
8	19-24	72	6
9	25-50	79	7
10	51+	77	2

In men, the DBW increases until puberty; it then declines

Table 4: The evolution of Delta Body Weight (DBW) during the lifespan of women, taken and modified from Ottaviani and Franceschi (2012)

Category	Age (years)	Body weight (kg)	DBW (kg)
1 Infants	0, 0 - 0, 5	6	-
2	0, 5 - 1, 0	9	3
3 Girls	1-3	13	4
4	4-6	20	7
5	7-10	28	8
6 Women	11-14	46	18
7	15-18	55	9
8	19-24	58	3
9	25-50	63	5
10	51+	65	2

In women, the DBW increases until puberty. It then declines

MATERIALS AND METHODS

We analyzed data from the evolution of body weight over one´s life time in healthy men (Table 1) and women (Table 2).

Then we proceeded to calculate the body weight delta for each case. For example, if the value of body weight is 72 kg and the row value is 76 kg, then the body weight delta is 4 kg.

Table 1 and 2, modified by the inclusion of the column indicating the body weight delta, are as represented in Table 3 and 4.

The data correlation between body weight and body weight delta (Table 3 and 4), was estimated using Pearson's test (r).

RESULTS AND DISCUSSION

The relationship between the evolution of body weight and the body weight delta in males can be seen in Fig. 1, while the corresponding relationship in women is shown in Fig. 2.

Both charts show that the body weight curve is always positive, it is monotonic, even if the value of the slope is changed, while the body weight delta curve changes both the value of the slope as its sign, it is not monotonic.

Until its tipping point, the body weight delta curve presents, both in men and in women, a clear correlation with the body weight curve. After that point, the correlation is not significant. At the time of puberty, around age 14 for women and 18 for men, the body weight corresponds to increases of body weight delta (r = 0.98).

Then the body weight delta declines and increases in body weight persist, although it is attenuated (r = 0.25). The decline of body weight delta relates to the change of the slope value of the body weight curve.

The increase of mass generating capacity is remarkable until puberty in both sexes and it is accompanied by an increase of generated body mass in both sexes. The body is able to increase its mass and it does so.

But with the recent differentiation of cell types which specialize during puberty, a point of maximum complexity is reached from which the ability to generate mass declines. Increases in generated body mass although attenuated, continue.

Until puberty the weight increase is associated with the development of new cell types.

Mass increase is not supported by an increase in complexity. However, the increase of weight after puberty is an in disputable fact.

It is evident that mass can be increased without increasing the complexity, as occurs after puberty.

Is it possible to increase the complexity without increasing the mass? We don't know, but the fact is that we observe no increase in complexity without an increase in body mass.

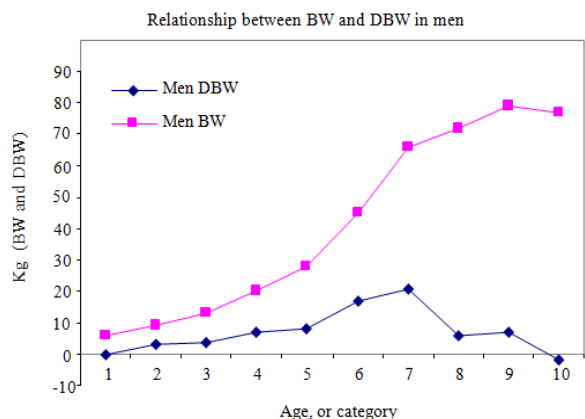An embryo is more complex than a zygote and a fetus is more complex than an embryo, just as a child of

Relationship between BW and DBW in men

Fig. 1: Relationship between BW and DBW in men (Made with data of Table 3)

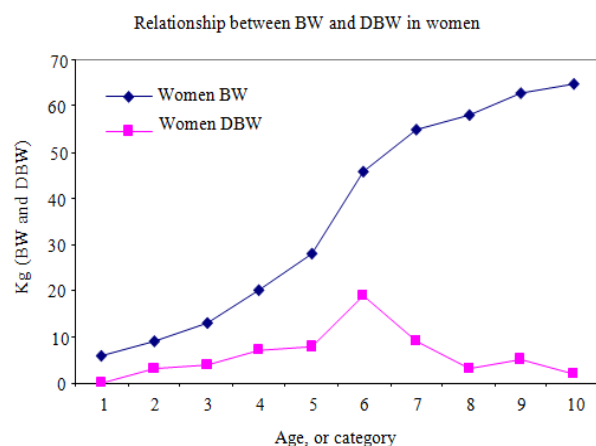Relationship between BW and DBW in women

Fig. 2: Relationship between BW and DBW in women (Made with data of Table 4)

four years old is more complex than a fetus. The limit is puberty, since an adult of 49 years old is no more complex than a 24 years old man, nor is and old man more complex than a pre-senile man.

When the highest complexity is reached, aging starts (the gradual decrease in the ability to generate mass and to maintain homeostasis) and there by the complexity related to generated mass will decrease.

At the species level, the phenomenon is also notable. Any multicellular organism is more complex than a single cell organism. The positive correlation that complexity has with body mass is beyond the level of biological organization being studied. (Barragán and Sánchez, 2012; Walker, 2005). It is not surprising that in complex multicellular organisms, aging is more noticeable than in the less complex ones.

After puberty no new cell types appear but there is still an increase in weight, at the same time the complexity of the organism declines. The end is predictable: when living beings cannot retain the lower

complexity that allows them to maintain vital functions they die, adding to the irreducible complexity.

The generation of complexity seems to require an increasing ability to generate mass. The present work does not investigate the reasons why the ability to generate mass declines. Likewise, the reasons that promote increased complexity in living beings have not been investigated either. This is not a matter left to chance, however, but rather appears to be linked to the relationship between energy dissipation and the ability to use it to generate structure, a precise design, not a random one, which supports the identity of living beings.

CONCLUSION

The mass produced, estimated as body weight, increases throughout the life span of human beings. This trend is accompanied by an increasing ability to generate estimated body mass such as body weight delta, until the time of puberty in both sexes.

After puberty the evolution of body weight and body weight delta curves differ. While the body weight delta curve declines, body weight continues to increase, although it is attenuated by the reduction of body weight delta. The dissociation of both curves coincides with the stage of life when the higher complexity is reached.

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