

DOI: 10.21767/2171-6625.1000242

# Allostatic Load and Allostatic Weight: A Literature Review of a Confusing Concept

Faustin Armel Etindele Sosso<sup>1,2,3\*</sup><sup>1</sup>Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal<sup>2</sup>Research Center of Neurosciences, Université du Québec à Montréal<sup>3</sup>Institut Santé et société, Université du Québec à Montréal**\*Corresponding author:** Faustin Armel Etindele Sosso, Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Montreal, Québec, Canada, Tel: +1 514-987-3000; E-mail: faustin.armel.etindele.sosso@umontreal.ca**Rec date:** December 16, 2017; **Acc date:** January 22, 2018; **Pub date:** January 24, 2018**Citation:** Etindele Sosso FA (2018) Allostatic Load and Allostatic Weight: A Literature Review of a Confusing Concept. J Neurol Neurosci Vol.9 No.1:242.

## Abstract

Allostatic load is a recent emerging concept, related to increase of clinical manifestation of stress. also named allostatic weight, it is a group of symptoms and dysfunction due to an intensive and permanent biological response to environmental and psychological stressors. It is not easy to identify clearly how its happened, when it started and during how many times response was higher. In definitive, researchers, patients and even health practitioners; are not currently able to handle this problem. In this review, we discuss about different approaches and definitions of what is an allostatic weight. We also give perspective and suggestion of what should be the next research in this context.

**Keywords:** Allostatic load; Allostatic weight; Psychological stress; Environmental stress; Cortisol; Mood disorders

## Introduction

In medicine and clinical sciences like psychology, the results of the biological analyses are considered normal when they are in a specific range considered as healthy by convention. That means, individual general state is stable and deprived (until proof of the opposite) of disease or apparent dysfunction. For example, the blood-pressure is regarded as normal if it is located under 130/90 mmHg. Same logic is valid for the glycemia when it lies between 4 and 6 of mmol/L. However, these normal values, do not mean that all is well and that the body is not experimenting another phenomenon, which will be noxious for him in the short or medium term. It is important to realize that the tools used for these examinations and diagnoses, just like those humans interpreting the results issuing from this equipment, are thus not infallible.

This logic is true for any measurement of constant or precise quantitative information such as the blood pressure, the body index of mass or the cholesterol level. It is even more true

when they are data which one cannot measure but can estimate precisely. We talk about concepts, paradigms or idea; without other values than those given to them by the individuals who measure them or undergo them. Among these concepts, one speaks about socio-economic status, faith or about allostatic load. There is also the fact that certain measurements have meaning only if they are combined with others. For example, measurements of DHEA (dehydroepiandrosterone) inform us about the estimated level of stress, when they are associated with the cortisol rate. If the rate of each of the two hormones is above normal limits, it is agreed that the stress is dangerous and should be controlled and treated. That remains a quantification of an estimation, that of a confused concept. In the present narrative review, the concept of weight allostatic is approached and demystified, followed by recommendations and the future perspective that; research brings to us on the subject.

## Literature Review

### Allostatic load

Recently, medical sciences like psychiatry, psychology and neurology; tried to describe and identify what it is known now as allostatic load [1-3]. Recently, progress was realized in the study of the processes, as well psychodynamic as biological, underlying the human adaptation to the experiment of the stressing environment [4-6]. Moreover, specificities of the psychopathological answers to stress and their optimal pharmacological assumption of responsibility remain badly elucidated. In addition, these last year's saw significant advances in the comprehension of the biological mechanisms and consequences of the stress for the brain, his skills and his homeostasis [7-9]. Whereas homeostasis is conceived as the maintenance of biological variables in fluctuation margins narrow; allostasy can be defined by the capacity to maintain stability through the change [10,11]. In this context, the excessive or deregulated activity of systems allostatic (adaptive) produced noxious effects for the brain (reduction of the neurogenesis, deterioration of the process of programmed death cellular, dendritic connection) and for the organization

(increase in the cardiovascular risk) [12-17]. These harmful effects of the cumulative stress were defined as the allostatic load or the cost inflicted at the organization for the maintenance of stability. The allostatic load is a concept referring all negative consequences of the stress on the organization which accumulates with time. The stress increases cortisol level (the main hormone involved in stress) which starts a cascade of adaptive internal events, during a short period [1,18-20]. If the period becomes too long, the stress is chronic and leads to a negative adaptive answer with consequences on several systems of the human body (cardiovascular, neuroendocrine, inflammatory, metabolic) [8,21,22]. Besides lying out with several chronic diseases, these consequences would also have as a result to decrease the capacity of the organization gradually to answer the stress adequately. Our organization could maintain a stable basal state compared an environment which changes constantly. For example, the body temperature, the quantity of oxygen transmitted to the brain or the pH of fabrics must remain inside certain quite precise parameters. Regarding the blood pH, for example, it must be maintained between 7.35 and 7.45. If these values change too much, we will die. We named homeostasis this innate capacity to maintain a state interior stable. Some other systems of the body operate in parameters much broader. For example, heart rate, the breathing and quantity of energy stored in the form of grease.

If the homeostasis term indicates the processes which make it possible the various systems of our organization to remain in balance, allostasy refers to the mechanisms ensuring stability at the physiological level with lasting stress. The biological answer of stress carries the organization of the mammal which we are with more vigilance, a better capacity to fight or flee, which supposes a short-term pressure on certain systems. Some of the latter function then temporarily apart from the standards considered as healthy or approach the higher limit of these standards. When this reaction continues, the regulation of the blood-pressure, the glycemia, cholesterol, as many other functions are affected [19,23-25]. The English weight or load allostatic indicates the consequences of this phenomenon of biological adaptation to the stress which continues. It is to some extent the weight of the biological consequences which one must support when one badly succeeds in solving a situation of stress which, because of this absence of resolution in time. However, this allostatic concept of weight also comes to put flat on the conclusions which one can draw from the current medical analyses. It stipulates that the fact that a result of analysis is in the standards does not mean that any danger is isolated. All depends on the results which some could show other measurements which, so must be made. Even if the blood-pressure, cholesterol, the glycemia, the triglycerides and the abdominal fat are normal, subject stay in danger if most of biological evaluation are within the higher limits of normality [6,24,26,27]. The danger is even larger if, month after month, we noticed an increase towards the higher limit. The whole of these measurements can exhibit an evil that each one, taken separately, could not indicate [28].

When many indicators approach the higher limit the standards, "You do not have anything, it is the stress" becomes

"You do not have yet only one can name disease, but your organization is seriously putting out of order itself and disability is come from there". Here are which changes gives it considerably regarding the need for a preventive action to undertake! Let us note that this disability could as much appear in the form of an infarction that under that of a depression.

### Allostatic weight

The diseases related to the stress are clearly in this category of diseases at multiple symptoms which, analyzed separately, show only seldom the imminence of a disability [13,29-32]. From where importance "to make the turn" of the symptoms and to consider the whole of the pressure which the body withstands rather than only one or the other of the symptoms whose intensity would prove to be indicating of pathology. The more so as the allostatic concept of weight will bring a preventive intervention or other curative that which only aims at replacing a symptom in the standards. It will aim at decreasing the stress at the base of the whole of the symptoms whose width shows that a broad disordered state is in place and risk to cause an important disability [33,34].

The action which targets a precise symptom is not obvious to proscribe; however, the relative success to make move back a symptom or another act only seldom overall of the disordered state which generated it and can even occult this unit. For example, the catch of statins will be able to make move back cholesterol, but it will not act on tiredness, insomnia, the headaches, the loss of the love of life and many the other symptoms which are present when the stress does not finish any more lasting [35]. The chronic stress activates the peripheral nervous system, neuro-endocrinal, and increases the risk of cardiovascular disease [36,37]. The chronic stimulation of the hypothalamo-hypophyseal-surrenalian axis can involve an imbalance of the anabolic-catabolic hormones. This situation leads to an excessive storage of visceral grease and an increase in resistance to insulin, leading to the prediabetic condition. The allostatic load is also the secondary result of a stressing environment [38,39]. The comprehension of these mechanisms and their cardio-metabolic effects must push us to reflect on the management of the chronic diseases. To reduce this load, one of the tools available to medicine is the therapeutic accompaniment. This one can be maintained by therapeutic education and source knowledge [40]. For example, usage of an antidepressant often has this effect to relieve the anxious or depressive symptoms somewhat; but it does not defuse that seldom the bomb with delayed-action which can explain these symptoms when it is the case – it be-with-to say when they are the consequence of a durable situation of stress, a situation which allows neither true rest nor serenity [28].

With the number of the touched functions, one finds the regulation emotional, the motivation, the perception and the interpretation of the events, the intellectual abilities, the increase in certain behaviors of compensation, the relational life as well as mood.

Roughly speaking, the emotional life becomes more intense and less controllable: irritability, anger, change of mood, unhappiness, frustration, suicidal behaviour. One is constantly worried, even obsessed by what stresses us, one makes more dramas with trifles, one develops a rather negative attitude towards more and more of things [41-43]. One loses enthusiasm and the motivation, one does the things by obligation, without pleasure, true interest. One is never again serene. One compensates by eating more sugar-fat-salt, while smoking more or by taking more alcohol or of coffee, one is more with the race, one as much as possible flees all that one can flee. One has difficulty concentrating, one is inattentive, one forgets full of things, one finds too complicated, one has obsessions [41-43]. One loses the taste to see people, one is more intolerant, one flees the close relations, the libido decreases. There is the feeling to be at the end of the roller, one does not know more with which values to hang up again itself, one has a feeling of a vacuum, one feels that something in oneself is broken, one feels disconnected from the life. Once again, each one of these symptoms is only seldom in itself an indication of disease or disordered state [44].

In the body, the chronic stress will touch all, of cholesterol to insomnia via the digestive system, the muscular tensions, the immune system and the balls in the throat or the stomach. If the symptoms can vary from one person to another, the fact that there is much remains a constant. A tiredness which never disappears also remains a relatively universal symptom.

If one or the other of these symptoms can prove source of sharp suffering, it is the significance of the unit which will bring us to the only relevant solutions: those which will make it possible to solve the difficulties at the base of the stress, which produces the biological reaction which is translated and appears by all these symptoms.

## Discussion

One can advantageously transpose this allostatic concept of weight in the field of the psychological symptoms. A situation of tension which lengthens unduly brings without any doubt a kind of formed psychological imbalance by symptoms which, considered separately, are not inevitably except standard and about never constitute indices valid to consult in psychiatry or neurology [40,45,46]. But the period which precedes and led to exhaustion and subsequent disability is punctuated of appearance and increase in signs in rupture with the usual operation of the touched person.

Rather than natural behavior or elements of the usual character of the person, these symptoms derive from an overload related to the need that it feels to find a go out with the situation with which it composes badly; they will disappear when the problem is solved, and that the life will be become again normal. Or, if the situation continues beyond the capacities of the body to support the most physical weight allostatic related to the chronic stress, they will have to expect the rest related to inevitable disability to reabsorb. It is only at this time to release taken obligatory which the mechanisms of homeostasis will take again of the service to give again with

the body its balance. Let us note on the way that the physical distinction/psychological rest here a way of speaking. It is shown indeed more and more that the hormones associated with the chronic stress affect the operation of the brain directly, increasing the work of the emotional brain, which work inhibits at least a little and sometimes much that of the cognitive surfaces [47-49]. From a practical point of view, one will have already easily noted that it is not when one swims in intense emotions which one takes the most intelligent decisions!

On the level as of organizations, one also knows that the periods when all must go quickly and where emotion is intense are often those where regrettable decisions are made. When the body bathes in the hormones of stress, the capacities of the body to call brain are affected. The mental health is not business only of psychology, intelligence or will.

## Future Perspectives

At this level of literature, allostatic load remains a confusing concept which is not understood by scientific community. We just raised interest in his symptoms and consequences, which are already studied in several area and disciplines. Like a retrospective study, it is possible to look in the past and try to exhibit how and when allostatic load started. It may be possible that what it is known as depression and anxiety, despite of obvious metabolic and hormonal dysregulation unrevealed recently; another manifestation of allostatic load.

## Recommendations

### Clinical investigations

- The cortisol is not enough to measure the allostatic load. A simultaneous measurement of mood disorders, sleep disorders, self-esteem and standards biological features like blood pressure and hematocrit; will certainly help prevents an allostatic load.

### Control and follow-up

- This combination of tests should be made regularly, every three months; to ensure an appropriate evaluation of the general state. It may also help epidemiologist to draw a picture of an allostatic load.

### Definition of concept

- A clear definition or at least a common approach of what is an allostatic load may help, clinicians, researchers, general population and caregivers; to well-educated themselves. It will also lead to some better guidelines to recognize and heal, symptoms and consequences induced by a permanent state of stress.

## Use of internet and social media

- People should be educated more with advertising through social media and free advertising inside video games, mobile games or kids programs on television. Even if a physical recognition of allostatic load is hard, at least a self-education about how reduce sources of stress; may help prevention of side effects.

## Conclusion

Although there is too little loss to actively occupy itself to rectify the situation-carrying stress, one would be wrong to believe that necessarily will cure us of our stomach-aches. The medical investigations remain a choice of first order when the body suffers, and it is known that the more one disease is detected early, the less it is likely to gain ground. Let us react in a convenient time, do not let the symptoms worsen.

But if we are told that one has nothing whereas one feels to crack of everywhere, there are great risks which one ends up falling sick from something which is not yet despicable for which does not consider the allostatic concept of weight. When one sees the signs accumulating at home, in a close relation or a colleague, it is important to look on the side of the stress. It is rare that one will not find an imbalance of life important. Let us endeavor to find a better balance. Our body will be able to give us an account of it.

## References

- Chen X, Redline S, Shields AE, Williams DR, Williams MA (2014) Associations of allostatic load with sleep apnea, insomnia, short sleep duration, and other sleep disturbances: Findings from the National Health and Nutrition Examination Survey 2005 to 2008. *Ann Epidemiol* 24: 612-619.
- Slopen N, Williams DR (2014) Discrimination, other psychosocial stressors, and self-reported sleep duration and difficulties. *Sleep* 37: 147-156.
- Etindele Sosso FA, Raouafi S (2016) Brain disorders: Correlation between cognitive impairment and complex combination. *Mental Health in Family Medicine* 12: 215-222.
- Etindele Sosso FA (2017) Negative involvement of the working environment in the occurrence of cognitive disorders. *Transl Biomed* 8: 2.
- Prairie BA, Wisniewski SR, Luther J, Hess R, Thurston RC, et al. (2015) Symptoms of depressed mood, disturbed sleep, and sexual problems in midlife women: cross-sectional data from the Study of Women's Health Across the Nation. *J Womens Health (Larchmt)* 24: 119-126.
- Roskoden FC, Kruger J, Vogt LJ, Gärtner S, Hannich HJ, et al. (2017) Physical activity, energy expenditure, nutritional habits, quality of sleep and stress levels in shift-working health care personnel. *PLoS One* 12: e0169983.
- Gosling JA, Batterham PJ, Glozier N, Christensen H (2014) The influence of job stress, social support and health status on intermittent and chronic sleep disturbance: an 8-year longitudinal analysis. *Sleep Med* 15: 979-985.
- Jiang Y, Yang M, Wu H, Gu J (2015) The relationship between disease activity measured by the BASDAI and psychological status, stressful life events, and sleep quality in ankylosing spondylitis. *Clin Rheumatol* 34: 503-510.
- Pereira D, Gross S, Elfering A (2016) Social stressors at work, sleep, and recovery. *Appl Psychophysiol Biofeedback* 41: 93-101.
- Lane CA, Hardy J, Schott JM (2017) Alzheimer's disease. *Eur J Neurol* 25: 59-70.
- Wisden W, Yu X, Franks NP (2017) GABA receptors and the pharmacology of sleep. *Handb Exp Pharmacol*.
- Etindele Sosso FA, Hito M, Bern S (2017) Basic activity of neurons in the dark during somnolence induced by anesthesia. *J Neurol Neurosci* 8: 203.
- Etindele Sosso FA (2017) Visual dot interaction with short-term memory. *Neurodegener Dis Manag* 7: 183-190.
- Appelhans BM, Fitzpatrick SL, Li H, Cail V, Waring ME, et al. (2014) The home environment and childhood obesity in low-income households: indirect effects via sleep duration and screen time. *BMC Public Health* 14: 1160.
- Aziz M, Osondu CU, Younus A, Malik R, Rouseff M, et al. (2017) The association of sleep duration and morbid obesity in a working population: The Baptist Health South Florida employee study. *Metab Syndr Relat Disord* 15: 59-62.
- Bertrand JA, Mcintosh AR, Postuma RB, Kovacevic N, Latreille V, et al. (2016) Brain connectivity alterations are associated with the development of dementia in Parkinson's disease. *Brain Connect* 6: 216-224.
- Eshkoo SA, Hamid TA, Nudin SS, Mun CY (2014) Importance of hypertension and social isolation in causing sleep disruption in dementia. *Am J Alzheimers Dis Other Demen* 29: 61-66.
- Baron KG, Reid KJ (2014) Circadian misalignment and health. *Int Rev Psychiatry* 26: 139-154.
- Fiske A, Wetherell JL, Gatz M (2009) Depression in older adults. *Annu Rev Clin Psychol* 5: 363-389.
- Slopen N, Lewis TT, Williams DR (2016) Discrimination and sleep: A systematic review. *Sleep Med* 18: 88-95.
- Green MJ, Benzeval M (2013) The development of socioeconomic inequalities in anxiety and depression symptoms over the lifecourse. *Social Psychiatry and Psychiatric Epidemiology* 48: 1951-1961.
- Guo X, Zheng L, Wang J, Zhang X, Zhang X, et al. (2013) Epidemiological evidence for the link between sleep duration and high blood pressure: A systematic review and meta-analysis. *Sleep Med* 14: 324-332.
- Anang JB, Nomura T, Romenets SR, Nakashima K, Gagnon JF, et al. (2017) Dementia predictors in Parkinson disease: A validation study. *J Parkinsons Dis* 7: 159-162.
- Canuto R, Garcez AS, Olinto MT (2013) Metabolic syndrome and shift work: A systematic review. *Sleep Med Rev* 17: 425-431.
- Chibnik LB, Wolters FJ, Backman K, Beiser A, Berr C, et al. (2017) Trends in the incidence of dementia: design and methods in the Alzheimer Cohorts Consortium. *Eur J Epidemiol* 32: 931-938.
- Bertrand JA, Bedetti C, Postuma RB, Monchi O, Génier Marchand D, et al. (2012) Color discrimination deficits in Parkinson's disease are related to cognitive impairment and white-matter alterations. *Mov Disord* 27: 1781-1788.

27. Montembeault M, Joubert S, Doyon J, Carrier J, Gagnon JF, et al. (2012) The impact of aging on gray matter structural covariance networks. *Neuroimage* 63: 754-759.
28. Chen ES, Gigeck CO, Rosenfeld JA, Diallo AB, Maussion G, et al. (2014) Molecular convergence of neurodevelopmental disorders. *Am J Hum Genet* 95: 490-508.
29. Etindele Sosso FA (2017) Sleep disorders and insomnia: Effects on a young population. *Psychology and Psychiatry* 2: 26-32.
30. Etindele Sosso FA, Raouafi S (2016) Appropriate sleep duration and physical activity modulate cognitive improvement. *J Sleep Disor: Treat Care* 5: 4.
31. Etindele Sosso FA, Nakamura O, Mitsu N (2017) Evaluation of combined effects of insomnia and stress on sleep quality and sleep duration. *J Neurol Neurosci* 8: 202.
32. Etindele Sosso FA, Raouafi S (2017) An overview of positive interaction between exercise and mental health. *J Neurol Neurosci* 8: 215-219.
33. Dugas E, Low NC, Rodriguez D, Burrows S, Contreras G, et al. (2012) Early predictors of suicidal ideation in young adults. *Can J Psychiatry* 57: 429-436.
34. Richard-Devantoy S, Ding Y, Lepage M, Turecki G, Jollant F (2016) Cognitive inhibition in depression and suicidal behavior: A neuroimaging study. *Psychol Med* 46: 933-944.
35. Tobaldini E, Costantino G, Solbiati M, Cogliati C, Kara T, et al. (2016) Sleep, sleep deprivation, autonomic nervous system and cardiovascular diseases. *Neurosci Biobehav Rev* 74: 321-329.
36. Carson V, Tremblay MS, Chaput JP, Chastin SF (2016) Associations between sleep duration, sedentary time, physical activity, and health indicators among Canadian children and youth using compositional analyses. *Appl Physiol Nutr Metab* 41(6 Suppl 3): S294-302.
37. Jalali-Farahani S, Amiri P, Chin YS (2016) Are physical activity, sedentary behaviors and sleep duration associated with body mass index-for-age and health-related quality of life among high school boys and girls? *Health Qual Life Outcomes* 14: 30.
38. Etindele Sosso FA (2016) Cognitive impairment is correlated with and unstable mental health profile. In: *Proceedings of 5th International Conference on Alzheimer's Disease and Dementia*.
39. Etindele Sosso FA, Molotchnikoff S (2016) Relationship between cognitive impairment and the combined effects of environmental factors. Presented at: 2nd Expert Annual Meeting on Neurocognitive Disorders and Stress Management.
40. Etindele Sosso FA (2017) African burden of mental health: Rethinking primary care in mental health. *J Alzheimer's Parkinsonism & Dementia* 2: 1.
41. Breton JJ, Labelle R (2015) Suicidal behaviour protective factors in adolescents. *Can J Psychiatry* 60: 1-4.
42. Encrenaz G, Kovess-Masfety V, Gilbert F, Galéra C, Lagarde E, et al. (2012) Lifetime risk of suicidal behaviors and communication to a health professional about suicidal ideation. Results from a large survey of the French adult population. *Crisis* 33: 127-136.
43. Jollant F, Lawrence NL, Olie E, Guillaume S, Courtet P (2011) The suicidal mind and brain: A review of neuropsychological and neuroimaging studies. *World J Biol Psychiatry* 12: 319-339.
44. Richard-Devantoy S, Jollant F, Deguigne F, Letourneau G (2013) Neurocognitive markers of suicide vulnerability in the elderly: a review. *Geriatr Psychol Neuropsychiatr Vieil* 11: 367-378.
45. Etindele Sosso FA, Nakamura O, Nakamura M (2017) Epidemiology of Alzheimer's Disease: Comparison between Africa and South America. *J Neurol Neurosci* 8: 204-207.
46. Etindele Sosso FA, Nakamura O, Mitsu N (2017) African burden of Mental Health: Necessity of global exchange between researchers. *Journal of Advanced Research in Biotechnology* 2: 1-2.
47. Gagnon JF, Postuma RB, Joncas S, Desjardins C, Latreille V (2010) The Montreal cognitive assessment: A screening tool for mild cognitive impairment in REM sleep behavior disorder. *Mov Disord* 25: 936-940.
48. Groch S, Preiss A, McMakin DL, Rasch B, Walitza S, et al. (2017) Targeted reactivation during sleep differentially affects negative memories in socially anxious and healthy children and adolescents. *J Neurosci* 37: 2425-2434.
49. Segura-Jimenez V, Estevez-Lopez F, Soriano-Maldonado A, Álvarez-Gallardo IC, Delgado-Fernández M, et al. (2016) Gender differences in symptoms, health-related quality of life, sleep quality, mental health, cognitive performance, pain-cognition, and positive health in Spanish fibromyalgia individuals: The Al-Andalus Project. *Pain Res Manag*.