

The Portuguese version of the Horne and Ostberg morningness-eveningness questionnaire: its role in education and psychology

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Abstract: In this article we describe the adaptation, validation and standardisation of Horne & Ostberg's *Morningness-Eveningness type questionnaire* Portuguese version. We compare our results with Brazilian's results. The final version of the questionnaire is composed by 16 items that allow the evaluation of morningness-eveningness "degree": an individual is more matutine (lark) as more elevated is the total value obtained in the scale. The morningness is an important characteristic regarding the inter-individual differences in circadian rhythms and it has several implications in Education, Shift work and Jet Lag. **Key words.** morningness-eveningness, circadian rhythms, psychophysiology, education, psychology, shift work.

Resumo: Neste artigo apresentam-se os resultados da adaptação, validação e aferição da versão portuguesa do *Morningness-Eveningness type questionnaire* de Horne e Ostberg. Comparamos os nossos resultados com os resultados obtidos com a versão brasileira. A versão final apresenta 16 itens que permitem medir o "grau" de matutindade-vespertinidade: um indivíduo é tanto mais matutino (cotovia) quanto maior é o valor total obtido na escala.

A matutindade-vespertinidade é uma característica importante relativamente às diferenças individuais no âmbito dos ritmos circadianos, com implicações diversas em domínios como a Educação, o Trabalho por Turnos e a Travessia Rápida de Fusos Horários. **Palavras-chave:** matutindade-vespertinidade, ritmos circadianos, psicofisiologia, educação, psicologia, trabalho por turnos.

Introduction

Morningness-eveningness is an important aspect of individual differences in circadian rhythms (Horne & Osteberg, 1976;

Kleiven, Haugstad, Tønnesses & Tynes, 2000), and circadian rhythms are a central topic in psychophysiology (Selva, 1995) and applied psychology, namely in education (Monte-Arroio, Silva, Silvério, Pereira & Alves, 2000; Montagner, Roquefeuil & Djakovic, 1994; Reinberg 1994) and organisational areas (Azevedo, 1980; Silva, 2000; Costa, 2000; Folkard & Hunt, 2000).

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This variable has been important in the scientific research since the work of O'Shea (1900). Kerkhof (1985) states that the morning/evening-type dimension is the most important determinant associated with reliable inter individual differences in circadian rhythm. So, a large number of paper and pencil scales of morningness-eveningness have been developed over the years and have been shown to relate to phase differences in core body temperature and subjectively rated alertness rhythms (Folkard & Hunt, 2000).

Despite the critic made by Folkard in 1975, for whom the inter-individual differences in daily peak times of performance are not very evident, Oquist, in 1970 (cit. by Benedito-Silva, Menna-Barreto, Marques & Tenreiro, 1990), developed a Swedish language Morningness-Eveningness questionnaire which appeared to be able to distinguish between the two extremes of the circadian rhythm type (morningness-eveningness). In 1973, Ostberg modified the questionnaire for a study about food intake and oral temperature circadian rhythms, and concluded that it distinguishes the two types (Horne & Ostberg, 1976). After this study, Ostberg re-designed the questionnaire for a shift work study and concluded that it is able to distinguish individual differences about suitability to shift work. Ostberg (1973) concluded that Morning types did not adapt their habits to the needs of shift work as readily as Evening types, and that Morning types have a more autonomous circadian rhythm. In 1976, Horne and Ostberg made a study with an English version of the questionnaire. In that study, "*results showed that Morning types had a significantly earlier peak time than Evening types and tended to have a higher daytime temperature and lower post peak temperature ... Morning types retired and*

arose significantly earlier than Evening types" (pp. 97).

In another study with shift workers, Kleiven, Haugsdahl, Tønnesses and Tynes (2000) found that diurnal urinary 6-sulphatoxymelatonin excretion (a good indicator of plasma melatonin level) show a positive correlation with evening-types both for a control night and for three days of night work on a continuous, rapidly rotating shift. They also found a larger reduction and a faster normalisation in nightly excretion for evening-types when compared to morning-types.

Benedito-Silva, Menna-Barreto, Marques and Tenreiro (1990) made a research with their Brazilian language questionnaire and found similar results.

A Portuguese version is needed, because the diurnal type (Morning and Evening) is an important variable in education and psychology.

For example, Folkard (1975) showed that there is a diurnal variation in logical reasoning and Freeman and Hovland (1934) found that there are diurnal variations in performance and related physiological processes. Klein and Armitage (1979) obtained the most illustrative results in the variation of cognitive style, apparently related with the BRAC cycle.

In several studies with students, since the first school year until the university, Testu (1982, 1986, 1989) found that the level of intellectual performance is low in the morning (between 8 a.m. and 9 a.m.) and the acrophase is near midday. He also found that near 2 p.m. the level shows a little drop and after 3 p.m. appear the highest values. In a study with 756 Portuguese students, 264 boys and 492 girls (secondary school), we found it is in the afternoon that there are more students with academic success (Monte-Arroio, Silva,

Silvério, Pereira & Alves, 2000). Regarding the academic success, we didn't found an interaction between morningness-eveningness type and timetables, because 92,3% of the individuals are intermediates. In organisational psychology, namely in the shift work issue, there are many studies about the predictive value of diurnal type. For example, in a study of Folkard and Hunt (2000), with 42 permanent day shift workers and 40 permanent night shift workers, recruited for the study from an anonymous light engineering company, the morning-types reported fewer psychological health problems than the evening-types in both the day-working and the night-working groups. It appears that there is a contradiction with previous findings according which evening-type individuals show greater circadian adjustment to night shift. Nevertheless, it is possible that adjustment facility impairs physical health, because the acrophases move together in the circadian phase map. All these data are important in applied psychology, namely in organisational and educational psychology (Silva, 2000). Additionally, Horne & Ostberg questionnaire is the most used questionnaire to evaluate the diurnal type. So, the aim of this study is to design and evaluate a Portuguese version of the Horne & Ostberg Morningness-Eveningness questionnaire.

Materials and Methods

The Horne and Ostberg English language Morningness-Eveningness questionnaire (H&O-ME) was translated into Portuguese language. In order to avoid ambiguity and false answers, we took care with phraseology, shortness and clarity of questions.

The first version of Portuguese language questionnaire, "Questionário de Matutividade-Vespertinidade de Horne e Ostberg" (QMV-H&O), had 20 items (19 items translated from English language questionnaire and a 20th added by us). According to the English language questionnaire, each item has 4 possible answers indicating Definitely Morning, Moderately Morning, Moderately Evening and Definitely Evening types. The highest numbers indicate definite Morningness, and the lowest number definite Eveningness. The time scales (items 1, 2, 10, 17 and 18) were answered in a 1 - 5 range, in the direction from high Eveningness to high Morningness. In the items 1, 2, 10, 17 and 18, the cross made along each scale is referred to the appropriate score value range underneath the scale. For the other items, the appropriate score for each response is displayed in the answer box. The scores are added and the sum is converted into a five point Morningness-Eveningness scale.

We applied the first version of the QMV-H&O to a sample of 508 Portuguese individuals, representative of the country and stratified according to the 2001 Portuguese Census (by age, gender and academic degree), 223 males and 285 females, with ages between 15 and 94 years ($M=39.61$; $SD=18.04$), without significant differences in age between males and females ($t=.662$; $df=505$; $p=.51$). After scoring, we made a statistical analysis with the SPSS 10.0 package.

Results

First we tested the distribution of the responses into the 4 classes for all items, and we found that 4 items (items 1, 8, 9 and 20 of the first version) were rejected

because they didn't show a normal distribution.

After that, a principal component analysis (varimax type rotation and eigenvalues >1) was made with the 16 items (items 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17,

18 and 19) and we found a rotated component matrix with five factors (Table 1). Total variance explained is equal to 55,7 %, which is considered a good percentage (Comrey, 1973).

TABLE 1 - Rotated Component Matrix of QMV-H&O

Items	Components				
	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5
Item 12	.738	..	...	...	...
Item 10	.717	...	...	...	...
Item 2	.665	...	...	...	...
Item 7	...	.714	...	...	...
Item 5	...	.661	...	...	...
Item 4	...	.604	...	...	...
Item 6	...	.536	...	...	...
Item 3	...	...	.780	...	...
Item 13	...	...	.663	...	...
Item 14	...	...	.593	...	...
Item 15	...	...	...	.777	...
Item 11	...	...	...	.683	...
Item 16	...	...	...	.635	...
Item 18	...	..	...	...	.708
Item 17	...	...	...	...	.705
Item 19	...	...	...	...	.503
% of Variance	11.89	11.81	11.05	10.36	9.39

According to the contents of the items (see Appendix) for each factor, we labelled the factors as:

Factor 1 (items 2, 10 and 12): *wake-sleep habits* (12,9% of variance);

Factor 2 (items 4, 5, 6 and 7): *activation* (11,8% of variance);

Factor 3 (items 3, 13 and 14): *independence from homeostasis* (11,0% of variance);

Factor 4 (items 11, 15 and 16): *performance* (10,4% of variance);

Factor 5 (items 17, 18 and 19): *diurnal-type awareness* (9,4% of variance).

The Alpha (reliability analysis) is .75, which is a very good coefficient (Bravo & Potvin, 1991).

According to Horne and Ostberg's criteria for classification in one of the 5 categories (DM, MM, IN, ME and DV), we found

a strong displacement towards "Indifferent" type. So, based on the results, the interval limits defining each type were changed in order to eliminate this displacement, as should be expected from a normal distribution. Consequently, we obtained the following cut off points through percentiles (5, 25, 75 and 95):

DE (Definitely Evening): QMV-O&H sum < 31;

ME (Moderately Evening): 31 £ QMV-O&H sum £ 42;

IN (Indifferent): 43 £ QMV-O&H sum £ 53;

MM (Moderately Morning): 54 £ QMV-O&H sum £ 59;

DM (Definitely Morning): QMV-O&H sum > 59.

Using these criteria for the final QMV-O&H, we found a distribution for the entire

population (Table 2) similar to the distributions obtained by Benedito-Silva *et al* (1990).

TABLE 2 - Sub-class distributions: Brazil and Portugal

Type	Brazil		Portugal	
	N	%	N	%
DM	30	5.7	20	4.3
MM	147	28.1	71	15.4
IN	264	50.5	248	53.9
ME	63	12.0	94	20.4
DE	18	3.2	27	5.9
TOTAL	522	100.0	560	100.0

In order to better understand the obtained data, we increased the number of subjects to eliminate the possibility of spurious results. We added 401 subjects (totalling 909 individuals). In this enlarged sample, 304 were men and 607 were women, aged

15 - 99 (Mean= 31.22; DP= 16.72).

In Table 3 we can observe a similar distribution in this enlarged population, when compared with the first 460 subject's sample (there are 48 missing values of the initial 508).

TABLE 3 - Morningness-eveningness distributions - 909 subjects

Type	Portugal - 909		Portugal - 460	
	N	%	N	%
DM	90	9.9	20	4.3
MM	171	18.8	71	15.4
IN	421	46.3	248	53.9
ME	183	20.1	94	20.4
DE	44	4.8	27	5.9
TOTAL	909	100.0	460	100.0

In the 909 subject's sample, the *cut off points* are similar to the cut off points of the 460 subject's sample:

DE (Definitely Evening): QMV-O&H sum < 30;

ME (Moderately Evening): 31 ≤ QMV-O&H sum ≤ 40;

IN (Indifferent): 43 ≤ QMV-O&H sum ≤ 52;

MM (Moderately Morning): 54 ≤ QMV-O&H sum ≤ 59;

DM (Definitely Morning): QMV-O&H sum > 59.

Finally, in this large sample, the questionnaire total score distribution closely correlated to the normal distribution (range= 19 - 68; Mean= 46,06; SD= 8,82)

and the men and women didn't differ significantly ($t= 0,940$; $df= 497,9$; $p= .348$) in their mean scores: for men, mean= 46,5 (SD= 9,38), and for women, mean= 45,9 (SD= 8,53).

Discussion and Conclusions

Morningness-eveningness preference is the individual difference that most clearly explains the diurnal variations in the rhythmic expression of behavioural and biological functions (Adan & Natale, 2002). Among many tools that evaluate the diurnal type, the Morningness-Eveningness questionnaire developed by Horne and

Ostberg has been translated into many languages, and today is the most frequently used in theoretical and applied scientific research.

Taillard, Philip, Chastang, Diefenbach and Bioulac (2001) in a study with 1165 non shift workers of the French national electrical and gas company, about the influence of the diurnal type on self-reported morbidity and health in an active population, found that, after adjustment for gender, age and occupational status, eveningness was associated with feeling less energetic ($p=.04$) and the morningness was associated with worse sleep ($p=.0001$). Results showed that morningness was related with difficulty in maintaining sleep ($p=.0005$) and the impossibility to return to sleep in the early morning ($p=.0003$) (sleep phase-advance syndrome), while eveningness was related with difficulty in initiating sleep ($p=.0001$) and morning sleepiness ($p=.0001$).

The importance of the quality of sleep in the psychomotor and intellectual performances is consensual and this was a strong reason to develop a Portuguese version of Horne & Ostberg's Morningness-Eveningness questionnaire to evaluate the diurnal type.

According to the results, we think that our Portuguese language questionnaire is a good tool for research purposes. In spite of the differences from Swedish, English and Brazilian questionnaires related *cut off points*, in general, we can conclude that it is a valid instrument with a very good Alfa coefficient.

Contrary to the study of Adan and Natale (2002), in our large sample, there are not statistical differences between men and women in morningness-eveningness total scores. On the other hand, the range of our sample is similar (our sample: range= 19 - 68; Adan and Natale: range= 17 -

78), as well as the means (our sample: Mean= 46,06; SD= 8,82; Adan and Natale: Mean= 48,25; SD= 10,11).

Adan and Natale (2002) found only three factors: *time of greatest efficiency* (items 6, 11, 15, 17, 18 and 19), *sleep time/sleep phase* (items 1, 2, 10, 12, 14 and 16) and *awakening time/sleep inertia* (items 3, 4, 5, 7, 8, 9 and 13).

Our Principal Component Analysis allowed the extraction of five factors. Our factors 2 (*activation*) and 3 (*independence from homeostasis*) can be related to the third factor (*awakening time/sleep inertia*) of Adan and Natale matrix (items 3, 4, 5, 7, 8, 9 and 13). The factors 4 (*performance*) and 5 (*diurnal-type awareness*) can be related to the first factor (*time of greatest efficiency*) of Adan and Natale matrix (items 6, 11, 15, 17, 18 and 19). The factor 1 (*wake-sleep habits*) can be related to the 2nd factor (*sleep time/sleep phase*) of Adan and Natale matrix (items 1, 2, 10, 12, 14 and 16). [The bold numbers are the items shared by the two studies].

The tridimensional structure of Adan and Natale is supported by the more recent model of human circadian regulatory system, namely the model of three processes: a self-sustained C factor (chronobiological), a homeostatic process (S), and a process of inertia which relates to the transition from sleep to waking conditions. Nevertheless, we think that our factorial structure is a meaningful one.

For the calculation of values by factor, in our final version the items are:

Factor 1 (*wake-sleep habits*): items 1, 7 and 9;

Factor 2 (*activation*): items 3, 4, 5 and 6;

Factor 3 (*independence from homeostasis*): items 2, 10 and 11;

Factor 4 (*performance*): items 8, 12 and 13;

Factor 5 (*diurnal-type awareness*): items 14, 15 and 16.

As our final version of the Horne and Osteberg questionnaire has less three items than the questionnaires from other

countries, we present a table (Table 4) with the correspondence between English and Portuguese items.

TABLE 4 - Correspondences of items between English and portuguese versioons

VRS	Items									
Engl	1	2	3	4	5	6	7	8	9	10
Port	...	1	2	3	4	5	6	...	...	7
VRS=version										
VRS	Items									
Engl	11	12	13	14	15	16	17	18	19	...
Port	8	9	10	11	12	13	14	15	16	...

VRS=version

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APPENDIX

Questionário de Horne e Oestberg

(Adaptado por Silvério, Silva e Macedo, 1998)

Data: ____/____/____

Nome: _____ Idade: _____

Sexo: Masculino () Feminino ()

Estado civil: _____

Residência: _____

Cód. Postal: _____ Tel.: _____

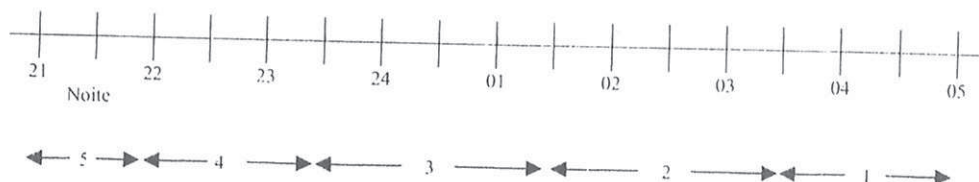
Profissão: _____

Horário habitual de trabalho: _____

Instruções:

1. Leia atentamente cada questão antes de responder.
2. Responda a **todas** as questões.
3. Responda às questões respeitando a sua ordem numérica.
4. Cada questão deve ser respondida independentemente das outras; não volte atrás nem altere as respostas anteriores.
5. Para cada questão coloque apenas uma resposta (uma cruz no local correspondente); algumas questões têm escalas, neste caso, coloque a cruz no ponto apropriado da escala.
6. Responda a cada questão com toda a honestidade possível. As suas respostas e os resultados são **confidenciais**.
7. **Não se esqueça** de preencher os seus dados pessoais.

1. Considerando apenas o seu bem estar pessoal e tendo liberdade total para planejar a sua noite, a que horas se deitaria?



2. Até que ponto precisa do despertador para acordar a uma determinada hora de manhã?

Não preciso ----- ()

Preciso poucas vezes ----- ()

Preciso muitas vezes ----- ()

Preciso sempre ----- ()

3. Quando está em boas condições mentais, físicas e ambientais (ex.: temperatura do quarto agradável) com que facilidade acha que se levanta de manhã?

Nada fácil ----- ()

Pouco fácil ----- ()

Fácil ----- ()

Muito fácil ----- ()

4. Na primeira meia hora depois de ter acordado de manhã, em que medida se sente desperto?

Nada desperto ----- ()

Pouco desperto ----- ()

Desperto ----- ()

Muito desperto ----- ()

5. Depois de acordar, como é o seu apetite durante a primeira meia hora?

Muito mau apetite ----- ()

Mau apetite ----- ()

Bom apetite ----- ()

Muito bom apetite ----- ()

6. Depois de ter acordado de manhã, em que medida se sente cansado na primeira meia hora?

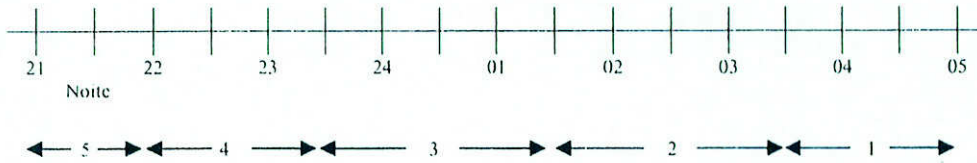
Muito cansado ----- ()

Cansado ----- ()

Fresco ----- ()

Muito fresco ----- ()

7. Habitualmente, a que horas da noite se sente cansado e com vontade de dormir?



8. Quer estar **no máximo da sua forma** para fazer um teste que dura duas horas e sabe que é mentalmente cansativo. Considerando o seu bem estar pessoal e com liberdade total para planear o seu dia, qual destes horários escolheria para fazer esse teste?

- Das 08:00 às 12:00 horas ----- ()
- Das 12:00 às 16:00 horas ----- ()
- Das 16:00 às 20:00 horas ----- ()
- Das 20:00 às 24:00 horas ----- ()

9. Depois de um dia normal, qual seria o seu nível de cansaço se tivesse que se deitar às 23:00 horas?

- Nada cansado - ----- ()
- Cansado ----- ()
- Muito cansado ----- ()
- Extremamente cansado ----- ()

10. Por alguma razão, foi dormir várias horas mais tarde do que é habitual. Se no dia seguinte não tiver hora certa para acordar, o que acontece?

- Acordo à hora habitual, sem sono ----- ()
- Acordo à hora habitual, com sono ----- ()
- Acordo à hora habitual, mas adormeço novamente -- ()
- Acordo mais tarde do que é habitual ----- ()

11. Se tiver de ficar acordado das 04:00 às 06:00 horas da manhã para realizar uma tarefa e não tiver nenhum compromisso no dia seguinte, o que faz?

- Durmo só depois de realizar a tarefa ----- ()
- Tiro uma soneca antes da tarefa e durmo depois ----- ()
- Durmo bastante, antes de realizar a tarefa, e tiro uma soneca depois -- ()
- Só durmo antes de realizar a tarefa ----- ()

12. Imagine que tem duas horas de exercício físico pesado para realizar. Considerando apenas o seu bem estar pessoal e tendo total liberdade para planear o seu dia, qual destes horários escolheria?

- Das 07:00 às 11:00 horas ----- ()
- Das 11:00 às 15:00 horas ----- ()
- Das 15:00 às 19:00 horas ----- ()
- Das 19:00 às 23:00 horas ----- ()

13. Decidiu fazer exercício físico "duro". Um amigo sugeriu o horário das 22:00 às 23:00 duas vezes por semana. Considerando apenas o seu bem estar pessoal, como acha que seria o seu desempenho se fizesse exercício entre as 22:00 e as 23:00?

Seria excelente ----- ()
 Seria bom ----- ()
 Seria mau ----- ()
 Seria muito mau ----- ()

14. Suponha que poderia escolher o seu próprio horário de trabalho e que deveria trabalhar cinco horas seguidas por dia, sendo possível efectuar pequenos intervalos nesse período. Imagine que seja um serviço interessante e que você ganharia pelos resultados da produção. A que horas começaria a trabalhar? [Assinale, colocando uma cruz (x) no quadrado por cima da respectiva hora]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

← 1 → → 5 → ← 4 → → 3 → → 2 → → 1 →

15. Em termos de bem-estar geral a que hora do dia se sente no seu melhor?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

← 1 → → 5 → ← 4 → → 3 → → 2 → → 1 →

16. Ouve-se dizer que há pessoas que funcionam melhor de manhã (tipo matutino) e pessoas que funcionam melhor à tarde/noite (tipo vespertino). Qual destes tipos acha que é?

Sem dúvida do tipo matutino ----- ()
 Mais matutino que vespertino ----- ()
 Mais vespertino que matutino ----- ()
 Sem dúvida do tipo vespertino ----- ()