HYPOTHALAMIC PITUITARY THYROID AXIS AND PERSONALITY DIMENSIONS IN A SAMPLE OF HEALTHY SUBJECTS

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AIMS

Clinical studies suggest hypothalamic-pituitary-thyroid axis (HPTA) to be involved in psychoaffective disorders, especially mood disorders (Hein & Jackson, 1990). Hypothyroidism and depression share some symptoms and many patients with depression have abnormal thyroid hormones levels (Kirkegaard & Faber, 1998). Increase in TSH level is generally considered to be a low thyroid function indicator. However, the role of HPTA in regulation of mood and behavior in non-psychiatric population remains poorly recognized.

In the present study we explore whether personality dimensions in healthy individuals might be related to serum thyroid hormones levels.
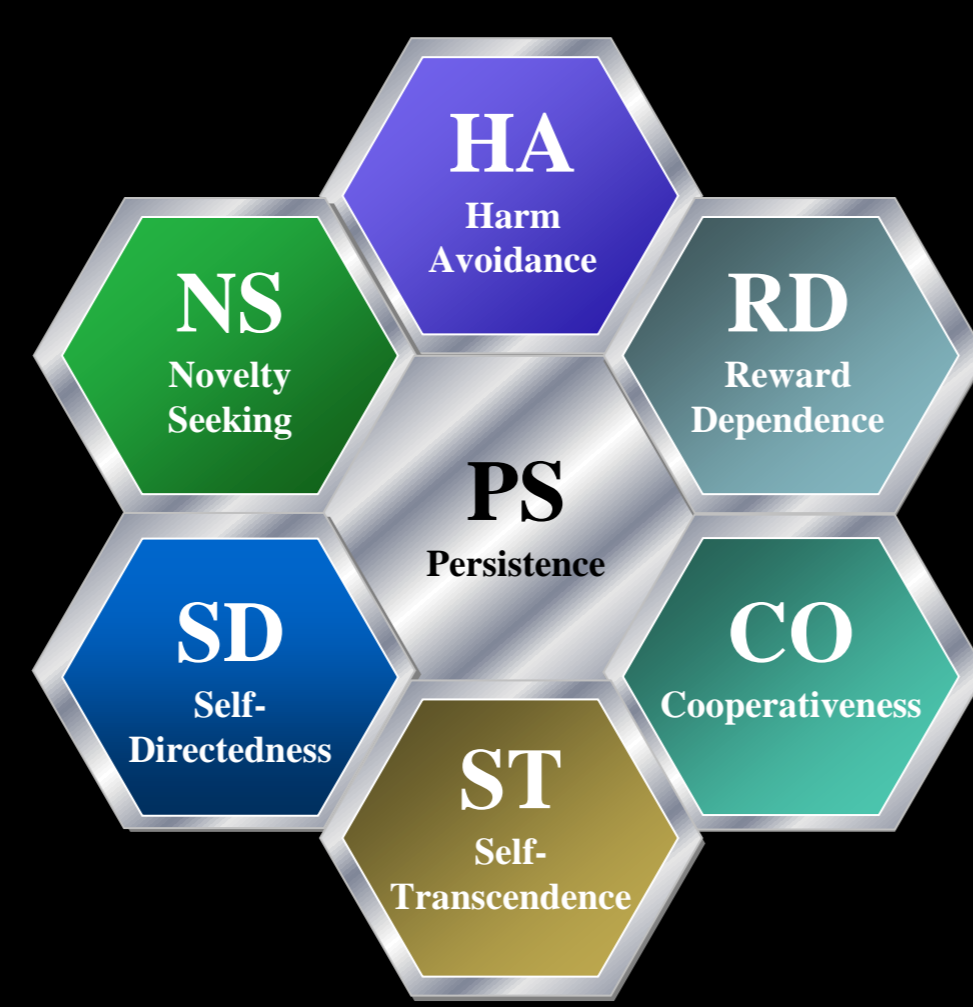
METHOD

Participants

A total of 104 healthy volunteers (46 male, 58 female, aged 18-55 years (35±12) were recruited for this study. An anamnestic schedule was filled in to assess the presence of any Axis I disorder, medical condition or any thyroid or psychotropic drug intake.

Psychological measures

All participants completed the short version of revised Cloninger's Temperament and Character Inventory (TCI-140).

A proportion of participants (71 subjects) completed the short version of the NEO Five Factor Inventory (NEO-FFI)

TCI-140
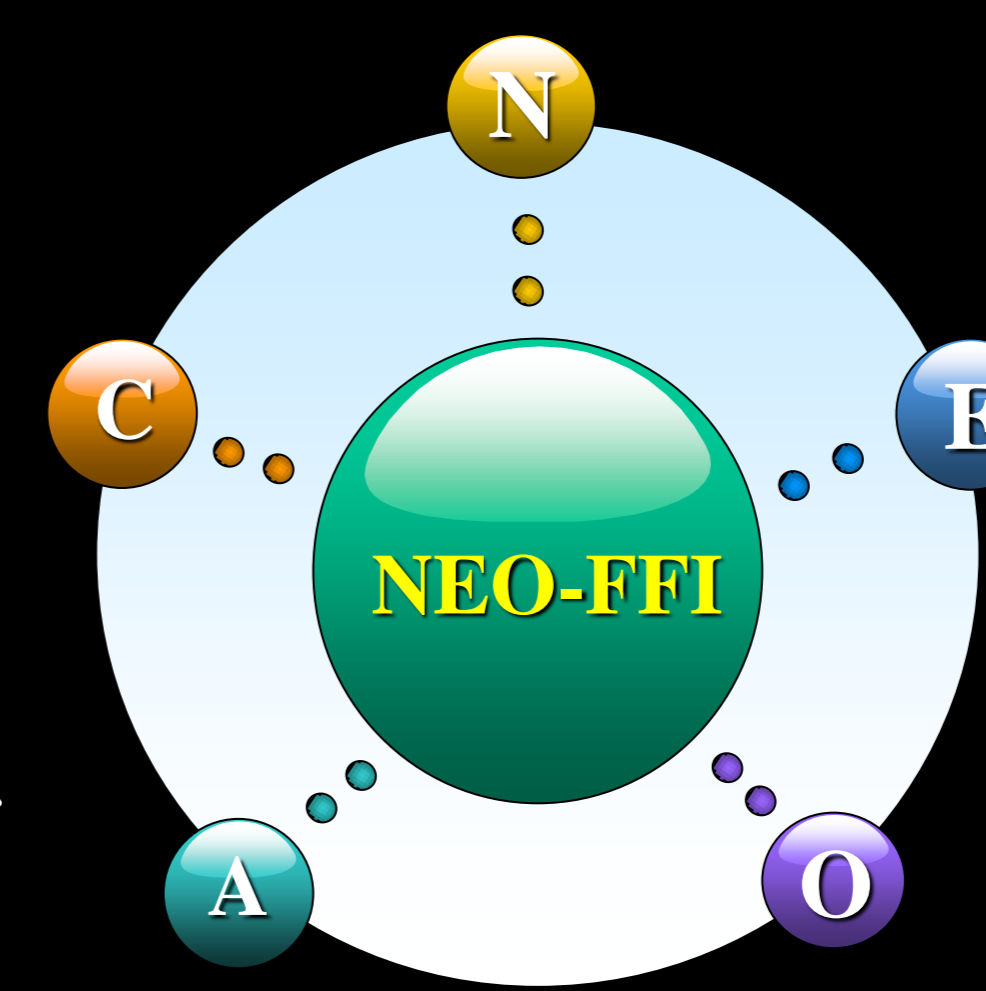
Thyroid hormones measures

Blood was collected in the morning between 8:00 a.m. and 10:30 a.m. after an overnight fast using separating gel tubes.

The levels of thyrotropin (TSH), total and free thyroxin (TT4 and FT4) and free triiodothyronine (FT3) were determined using automated chemiluminescence immunoassay

RESULTS

TCI-140	TSH	FT3	FT4	TT4
Novelty Seeking	-0.12	-0.04	0.11	0.03
Harm Avoidance	-0.24*	0.11	-0.07	0.04
Reward Dependence	0.06	-0.16	-0.19*	-0.06
Persistence	0.25**	-0.01	-0.02	-0.18
Self-Directedness	0.27**	-0.01	0.08	-0.08
Cooperativeness	0.16	-0.12	-0.05	-0.22*
Self-Transcendence	0.14	0.08	0.10	-0.12

NEO-FFI	TSH	FT3	FT4	TT4
Neuroticism	-0.30**	0.11	0.00	0.06
Extraversion	0.22	-0.01	-0.21	-0.11
Openness	0.01	-0.07	-0.16	-0.10
Agreeableness	0.19	-0.19	-0.10	-0.14
Conscientiousness	0.13	0.00	0.10	-0.15

Partial correlations between thyroid indices and personality scores controlled for age

TSH was negatively correlated to *HA* ($p<0.05$) and positively correlated to *PS* ($p<0.05$) and *SD* ($p<0.01$). FT4 was negatively correlated to *RD* ($p<0.05$). TT4 was negatively correlated to *CO* ($p<0.05$).
For the NEO-FFI dimensions, the only, but highly significant correlation, was the one between TSH and *N* ($p<0.01$)

Regression Analysis

D.V.	I.V.	B	F	P	R²
TSH	Persistence	0.22	7.69	<0.001	0.12
TSH	Self-Directedness	0.22	7.83	<0.001	0.14
TT4	Cooperativeness	-0.25	6.40	<0.01	0.10

We performed series of multivariate stepwise regression with thyroid hormones as dependent variable and personality scores as predictors. Age and sex were included as covariates.

In the case of *Temperament*, only the model for TSH reached statistical significance with standardized regression coefficient for *Persistence*. For *Character* dimensions, TSH serum level was positively related to *Self-Directedness* and TT4 negatively related to *Cooperativeness*. Using stepwise regression, NEO-FFI scales could not predict thyroid hormones levels with β statistically different from zero.

Graphical Analysis

The graphical analysis procedure using LOESS plots was performed in order to reveal possible non-linear relationships between thyroid hormones levels and personality dimensions. Personality raw scores were transformed in T-scores and thyroid hormones levels were transformed to Z-scores. For hormone axis, mean±2SD intervals were plotted as containing the highest density of observations.
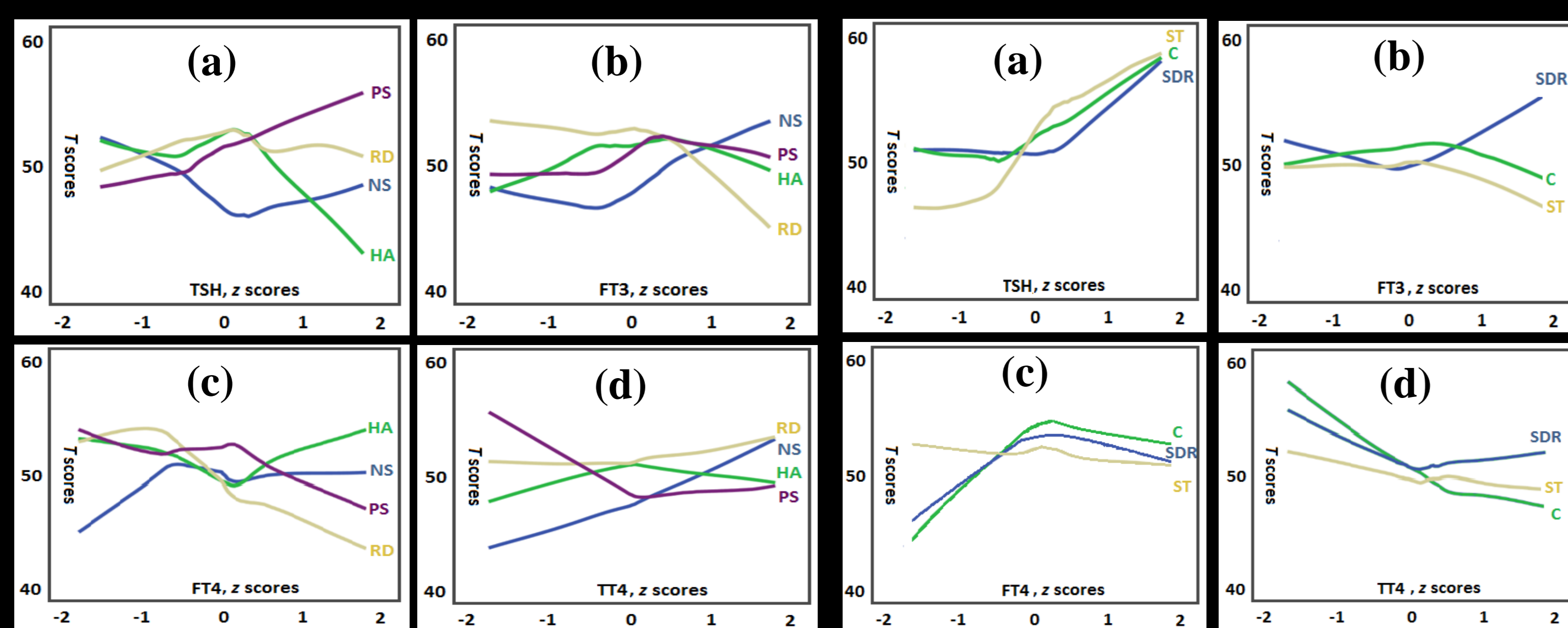
TSH was positively and almost linearly related to *Persistence*, confirming the results of correlation and stepwise regression (Fig. 1a). Subjects with TSH above mean value had a positive relationship between the hormone level and *Self-Directedness* and also showed a strong tendency for *Cooperativeness* and *Self-Transcendence* to be above the average (Fig. 2a). In respect to NEO-FFI, TSH was negatively related to *Neuroticism* in a linear manner (Fig. 3a).

Fig. 1. LOESS graphs for TCI *Temperament* scores and TSH (a), FT3 (b), FT4 (c), TT4 (d).
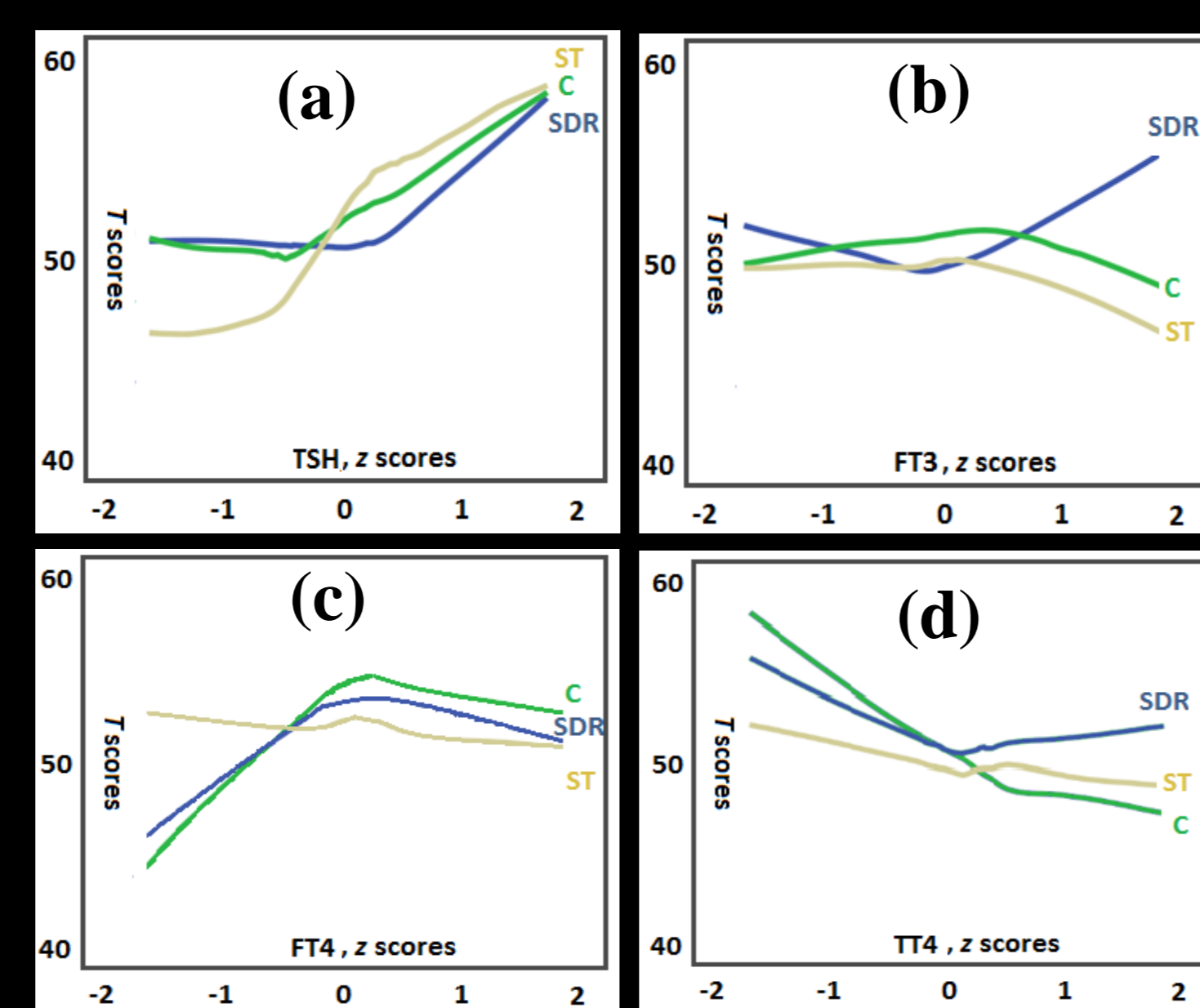NS: Novelty Seeking; HA: Harm Avoidance; RD: Reward Dependence; PS: Persistence.

Fig. 2. LOESS graphs for TCI *Character* scores and TSH (a), FT3 (b), FT4 (c), TT4 (d).
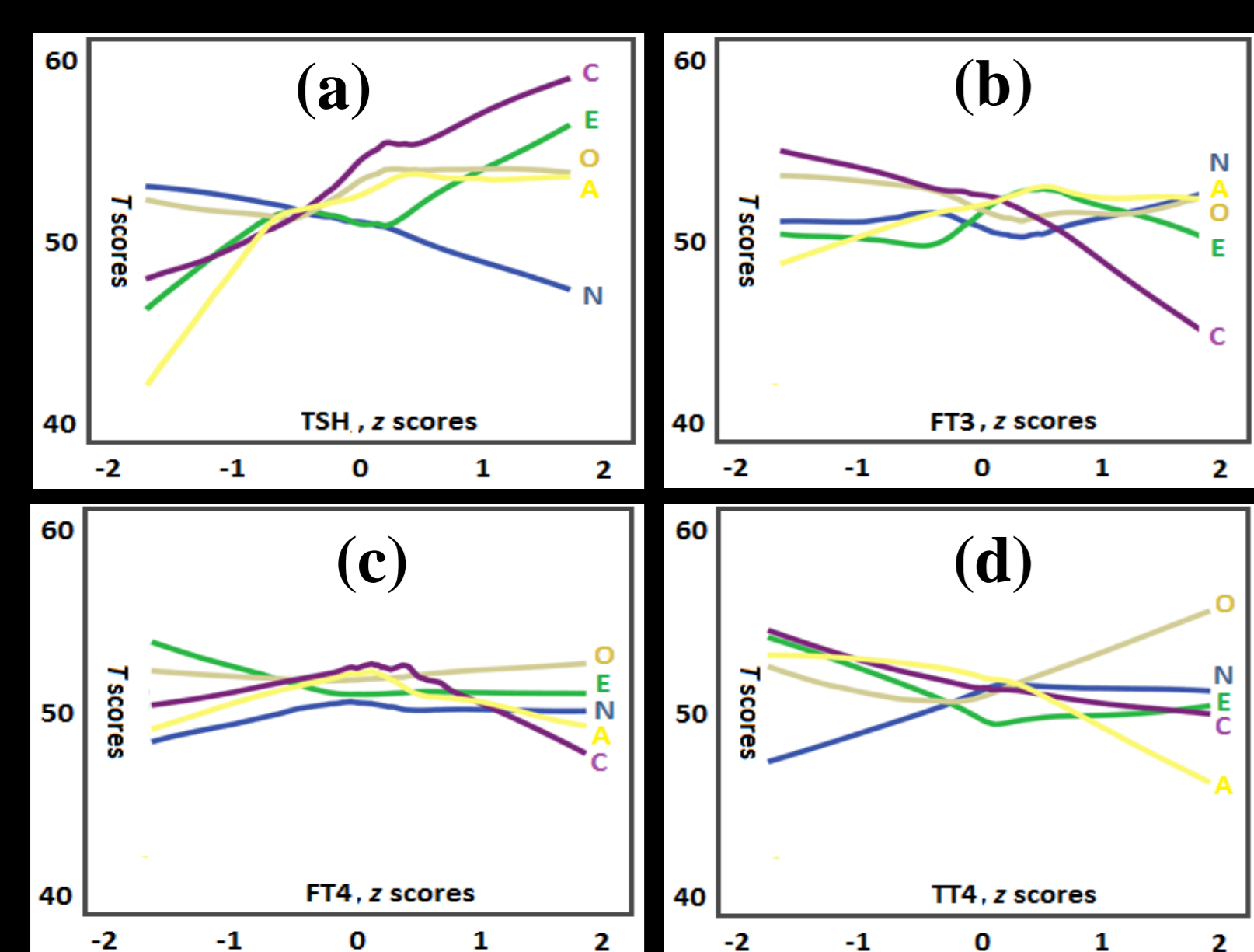SD: Self-Directedness; CO: Cooperativeness; ST: Self-Transcendence.

Fig. 3. LOESS graphs for NEO FFI scores and TSH (a), FT3 (b), FT4 (c), TT4 (d).
O: Openness; C: Conscientiousness; E: Extraversion; A: Agreeableness; N: Neuroticism.

FT3 was negatively related to *Reward Dependence* and positively related to *Novelty Seeking* but only for FT3 values above the mean (Fig. 1b). FT4 was significantly but not linearly related to low *Reward Dependence* (Fig. 1c). In addition, there were positive relationships between FT4 and both *Cooperativeness* and *Self-Directedness* for FT4 values below mean (Fig. 2c). TT4 showed a positive relationship with *Novelty Seeking* and a negative non-linear relationship with *Persistence* and *Cooperativeness*.

CONCLUSIONS

- TSH serum concentrations were positively associated with *Persistence* and *Self-Directedness* and negatively associated with *Harm Avoidance* and *Neuroticism*. These relationships suggest that higher TSH is associated with more adaptive personality profile (Spittlehouse et al., 2014).

- These relationships were independent on the levels of peripheral thyroid hormones (FT3, FT4, TT4). Hence, TSH personality correlations obtained are more likely to be associated with central but not peripheral thyroid function.

- Our data supports the hypothesis that decrease in serum TSH could represent the endophenotype associated with maladaptive personality profile.

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- Spittlehouse, J.K., Vierck, E., Pearson, J.F. & Joyce, P.R. (2014). Temperament and character as determinants of well-being. Compr. Psychiatry. 55(7), 1679-1687. doi:10.1016/j.comppsych.2014.06.011.